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**ACCOMPLISHING SHIPYARD WORK
FOR THE UNITED STATES NAVY:
INSTITUTIONS, SYSTEMS AND OPERATIONS
VOLUME 3: ANNOTATED BIBLIOGRAPHY**

Kenneth P. Heitze

August 1975

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skills required for ship construction versus depot maintenance in both naval and private shipyards; Navy procedures for placing shipyard work; shipyard performance indicators; and labor market for the shipbuilding and repair industry. The volume concludes with recommendations to improve the cost-effectiveness of performance of shipyard work and identifies several key areas for further study. Volume 2 is a compilation of appendixes containing additional material to support the basic report. Volume 3 is an annotated bibliography covering 150 documents related to subjects covered by this study.

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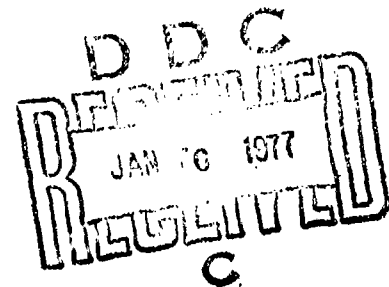
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FOREWORD

4 This volume includes the following material:

- As Contents, a bibliographical listing of abstracts of 150 documents that relate to the subject area of this study. The
- A Preface, the second page of which explains the coding of seven sources (one of which is parenthesized at the end of each bibliographical entry and, again, at the repetition of the entry as a heading for the text of the abstract).
- The 150 ^{core}abstracts arranged in reverse chronological order; abstracts (arranged alphabetically) for each year are preceded by a breaker page.
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116. *Department of the Navy Management Accounting for Facilities Maintenance and Utilities Operations*, by Comdr. Edwin C. Paul, USN (Washington: Industrial College of the Armed Forces, March 1967), 58 pp. (DLSIE-CB) 98
117. *Incentives for Achieving Component Standardization in Ship Construction*, sponsored by Office of the Assistant Secretary of Defense (Installations and Logistics) (Washington: Logistics Management Institute, Dec. 1967), 45 pp. (DLSIE-CB) 99
118. "Multi-Year Ship Procurement and Other Ship Acquisition Concepts," by Graeme C. Bannerman, *Journal of ASNE*, (Dec. 1967) (WEBB) 99
119. *Report on Indirect Government Aids to U.S. and Foreign Maritime Industries*, for Shipbuilders Council of America (Washington: Ernst and Ernst, April 1967) (WEBB) 100

120. *Sealog Ship Concept Study--Phase 2, V.5: Effect of Shipyard Automation on FDL Price*, by F. A. P. Frisch and V. L. Broussalian, sponsored by Department of the Navy, Office of the Chief of Naval Operations (Arlington VA: Center for Naval Analysis, May 1967), 42 pp. (DLSIE-CB) 100
121. "Ship Procurement--Isn't There a Better Way?" by Charles Zehen, SNAME Philadelphia Section, 21 October 1966 [also in *Marine Technology* (July 1967)] (WE3B) 100
122. *Study of Requirements for Naval Shipyard Capacity--1967*, by staff of Chief of Navy Material (Washington: Department of the Navy, Dec. 1967), approx. 100 pp., CONFIDENTIAL (IDA) 101
123. "Technical Data Management Problems and Procedures Concerning Engineering Support of Major Submarine Overhauls," by M. F. Page (Washington: Naval Ship Systems Command, 1967), 20 pp. (DLSIE-CB) 102
124. *U.S. Merchant Marine and Its Relationship to U.S. Foreign Trade*, by Capt. Paul C. Boyd, USN (Washington: Industrial College of the Armed Forces, April 1967), 164 pp. (DLSIE-CB) 102

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125. *1967 Shipbuilding and Conversion Program* (Washington: Department of the Navy, Office of the Chief of Naval Operations, June 1966), 58 pp. (DLSIE-CB) 103
126. *Economic Analysis of U.S. Shipbuilding Costs*, An, by Harry Williams, John D. Wells, Elizabeth R. Johnson, and Edward G. Sanders, IDA Report R-120 (Arlington VA: Institute for Defense Analyses, Economic and Political Studies Division, Dec. 1966), 158 pp. (IDA) 103
127. *Final Report on Industrial Conversion Potential in the Shipbuilding Industry*, by William R. Park and Robert E. Roberts (Kansas City MO: Midwest Research Institute, March 1966), 221 pp. (DLSIE-CB) 104
128. *Government Intervention in the Management of the United States Merchant Marine*, by Capt. Benjamin R. Eggeman, Jr., USN (Washington: Industrial College of the Armed Forces, Feb. 1966), 102 pp. (DLSIE-CB) 105
129. *Improvements in Complex Submarine Overhauls*, by Capt. W. A. Budding, Jr., et al. (Washington: Department of the Navy, Feb. 1966), approx. 150 pp., CONFIDENTIAL (IDA) . 105
130. (NAVSHIPS) *Shipyard Workload Study*, by the Shipyard Workload Study Group (Washington: Naval Ship Systems Command, Oct. 1966), approx. 200 pp. (incl. appendixes), CONFIDENTIAL (IDA) 106

131. *Prediction of Probable Damage in Naval Shipyards Resulting From Thermal Radiation of Nuclear Weapons and Subsequent Fire*, by P. V. Phung and A. B. Willoughby (Burlingame CA: United Research Services, July 1966), 202 pp. (DLSIE-CB) 108
132. *Prospects for Reducing U.S. Shipbuilding Costs, The* (Washington: Shipbuilders Council of America, March 1966) (WEBB) 108
133. *Review of Price Increases Under Shipbuilding Contracts, Department of the Navy* (Washington: GAO, Dec. 1966), 53 pp. (DLSIE-CB) 108
134. *Some Computer Applications for the Work Input and Control Phases of the Maintenance Cycle of Navy Public Works Centers*, by Lt. Comdr. Dean Gordon Wilson, USN (Monterey CA: Naval Postgraduate School, Aug. 1966), 94 pp. (DLSIE-CB) 109
135. *Toward a More Competitive Merchant Marine*, by Capt. Robert H. Ewing, USN (Washington: Industrial College of the Armed Forces, March 1966), 88 pp. (DLSIE-CB) 109

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136. *Conceptual Design of a Mechanical Shipyard for Fast Deployment Logistics (X) Production*, by Benjamin V. Andrews and Dan G. Haney (Menlo Park CA: Stanford Research Institute, Dec. 1965), 80 pp. (DLSIE-CB) 111
137. *Integrated Naval Shipyard Material Control System*, by Lt. D. R. Jahn, SC, USN, and Lt. Comdr. C. E. Sojka, SC, USN (Monterey CA: Naval Postgraduate School, 1965), 192 pp. (DLSIE-CB) 111
138. *Maritime Policy and Program of the United States: Report and Recommendations of the Public Members of the Maritime Advisory Committee, Submitted to the Full Committee for Its Consideration* (Nov. 1965), approx. 100 pp. (incl. dissenting minority reports) (IDA) 112
139. *Need for Improvement in Pricing of Change Orders for Construction of Naval Vessels, Department of the Navy* (Washington: GAO, Sept. 1965), 46 pp. (DLSIE-CB) . . . 113

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140. "Economic Considerations in Establishing an Overhaul Cycle for Ships: An Empirical Analysis," by D. E. Farrar and R. E. Apple, sponsored by Department of the Navy, Office of the Chief of Naval Operations (Arlington VA: Center for Naval Analysis, April 1964), 20 pp. (IDA) . 115
141. *Report on Capacity and Utilization of Private Shipbuilding and Ship Repair Facilities--1963* (Washington:

- Shipbuilders Council of America, April 1964)
(WEBB) 116
142. *United States Shipyards and the Effects of Disarmament*, by
D. M. Mack-Forlist, report submitted to Columbia Univ.,
1964 (WEBB) 116

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143. "Cost Savings of Multiple Ship Production, The," by John C.
Couch, SNAME Great Lakes and Great Rivers Section, 23
May 1963 [also in *International Shipbuilding Progress*
(Aug. 1963)] (WEBB) 117
144. *Estimating Ships' Maintenance Funding Requirements*, by Cen-
ter for Naval Analyses of the Franklin Institute, CNA
Study no. 40 (June 1963), 75 pp. + appendixes (IDA) . . 117

1962

145. *Report on Survey and Analysis of Differences Between U.S.
Navy Shipbuilding Costs at Naval and Private Shipyards*
(short title: *Shipbuilding Cost Study*) (Chicago:
Arthur Anderson and Company, Nov. 1962), approx. 250
pp. + appendixes (IDA) 119

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146. "Reducing Costs of American Ships," by L. C. Hoffman and
C. C. Tangerini, SNAME *Transactions*, 69 (1961) (WEBB) . 121
147. "Shipbuilding Costs as Seen by the Shipbuilders," by P. E.
Atkinson, SNAME New York Metropolitan Section, 23 March
1961 (WEBB) 121
148. "Some Modern Procedures for Shipyard Operation," by W. H.
Eckhardt and H. A. Jackson, SNAME New England Section,
24 June 1961 (WEBB) 121

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149. *Role of the U.S. Merchant Marine in National Security, The*,
Publication no. 748 (Washington: National Research
Council, National Academy of Sciences, 1959), 60 pp.
(IDA) 123

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150. *Shipyard MIS: A Manual for Users, The*, published by the Com-
puter Applications Support and Development Office
(CASDO) of the Naval Ship Systems Command (NAVSHIPS
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PREFACE

This volume presents abstracts of documents that relate to various aspects of U.S. shipyards. Though the area of primary interest is the complex of Naval Shipyards, the abstracts also cover documents relating to work on Navy ships in private shipyards. In general, the abstracted documents address various aspects of shipyard-wide management, administration, and planning. Of special interest are those documents that deal with overall manning of the yards or that treat shipyard capabilities, capacities, and utilization rates. (Documents that focus on technical processes are not included.)

In assembling this list, we gave priority to documents that resulted from a special research or study effort or that provide an historical perspective on the status and trends of shipyard management and its problem areas. Though these abstracts may unwittingly overlook some pertinent documents, we included not only all documents suggested as pertinent by knowledgeable DoD and Navy personnel but also other documents uncovered in our search of the literature.

In all, this volume presents 150 abstracts, which are arranged chronologically by year of publication (with the latest year first) and then, within each year, alphabetically by title. A colored (unpaginated) breaker page precedes the abstracts for each year.

Though nearly half the 150 abstracts were prepared for this study by IDA (fifth of seven designations below), the rest were supplied from other sources. Parenthesized initials at the end of the bibliographical entry for each abstract identify its source, as follows:

<u>Initials</u>	<u>Quantity</u>	<u>Source</u>
AUTH-MOD	1	Author-modified abstracts - based on those supplied by the author (with the document) but shortened or otherwise modified for use here (see Item 35).
CNA-MOD	2	Center for Naval Analysis (CNA), Arlington VA - abstracts composed by CNA personnel for several CNA documents, further digested or modified for use here (see Items 11 and 21).
DLSIE	6	<i>Defense Bibliography of Logistics Studies and Related Documents</i> (Jan. 1975), prepared by the Defense Logistics Studies Information Exchange (DLSIE), U.S. Army Logistics Management Center, Fort Lee VA - an annual compendium containing computer printouts of selected abstracts in the DLSIE files (see Items 27, 38-39, 46-47, and 61).
DLSIE-CB	58	Defense Logistics Studies Information Exchange (DLSIE), <i>Custom Bibliography</i> - DLSIE supplied IDA with a computer-printed bibliography of documents in its files (triggered for printout by several keyword designators supplied by IDA), from which larger set of abstracts IDA selected those deemed pertinent for inclusion here (see Items 3, 14-15, 30-32, 40, 43, 50-51, 55-56, 62, 66, 69, 71, 73-74, 77-80, 82-85, 87-88, 93-95, 97, 99-100, 104, 106, 110-17, 120, 123-25, 127-28, 131, 133-37, and 139).
IDA	71	Abstracts composed for this study by the Institute for Defense Analyses, Arlington VA (see Items 1-2, 4-10, 12-13, 17-20, 22-24, 25-26, 28-29, 33-34, 36-37, 41-42, 44-45, 48-49, 52-54, 57-58, 60, 63-65, 67-68, 70, 72, 75-76, 81, 86, 89-92, 96, 98, 101-03, 105, 108-09, 112, 126, 129-30, 138, 140, 144-45, 149-50).
NTIS	1	U.S. Department of Commerce, National Technical Information Service (NTIS), Port Royal Road, Springfield VA - abstract supplied by NTIS from its computer-network information exchange (see Item 16).
WEBB	<u>11</u>	"Improving the Prospects for United States Shipbuilding," Appendix A of <i>Final Report</i> , prepared by the Center for Marine Studies, Webb Institute of Naval Architecture (Jan. 1969) - this Webb report (which is itself abstracted as Item 98, below) contains abstracts of documents dealing with shipbuilding; eleven of these are selected for presentation here (see Items 107, 118-19, 121, 132, 141-43, and 146-48).
Total:	150	

1975

1. *Annual Report, Shipbuilders Council of America--1974* (Washington: Shipbuilders Council of America, March 1975), 36 pp. (IDA).

This annual report surveys the American Shipbuilding industry for the year in the broad context of its position in the world market. It also surveys activity in both Naval and merchant shipbuilding, reviews the year's Congressional legislative developments that affect industry management (i.e., procurement practices, industry earnings, types of material shortages, inflation effects), and cites a series of benchmarks achieved during the year. (See also Item 6--under 1974--the similar report for 1973; though only these two latest issues have been abstracted, issues of recent prior years exhibit a similar pattern of content.)

2. *Navy-Marine Corps Acquisition Review Committee (NMARC)*, 2 vols. (Washington: Department of the Navy, HQ Naval Material, Jan. 1975), approx. 1,100 pp. (IDA).

Established by the Secretary of the Navy in August 1974, NMARC assessed the organization, management, staffing, and procedures used by the Navy in developing and producing major weapon-systems. The committee consisted of high-level executives from industries that deal extensively with the Government and its DoD components, former DoD civilian executives at the Presidential-appointment level, and retired Navy flag officers. The group's main objective was to identify ways to reduce acquisition costs while maintaining the quality of weapon systems. The committee organized itself into five panels: R&D, Test and Evaluation, Procurement, Production, and Cost. These panels generally reflect the phases of the acquisition process, and the report's analysis and recommendations follow this pattern. The committee observes that the acquisition process for surface ships offers the most significant potential for improvement and, accordingly, devotes a special portion of the report to this area.

The findings and recommendations of the five panels indicate strongly that several major factors underlie many of the

individual problems being encountered in Navy material acquisition. Such factors include program and funding turbulence, difficulties of contracting in an inflationary environment, excessive involvement of higher staff levels in the direct management of programs, proliferation and expansion of organizations having review and approval authority (but contributing little to work performance), erosion of the credibility of Navy program-cost estimates and budgets among both OSD officials and Congress.

The thrust of the major findings fall into four categories:

- (1) *Preprogram Management Activities* (including program identification), based on mission deficiencies and examination of alternatives, R&D activities, acquisition, and long-range planning.
- (2) *Program Management Phase Activities*, which apply to the role, authority, and staffing support of the project manager; the problem of (organizational) layering; various aspects of procurement; contract administration, cost, and financial management; and test and evaluation.
- (3) *Shipbuilding* (the overall process is discussed).
- (4) *Government-Industry Relations* (the authors recap what can be done by both parties to assure a constructive acquisition environment).

The report gives special emphasis to the shipbuilding process, supplies an analysis of various problem areas, and offers specific recommendations for their solution; but, in general, it acknowledges that the solutions are not expected to be simple to achieve. (N.B. Vol. I contains the actual report; Vol. II, the annexes and appendixes.)

1974

3. *Aid for the Allocation of Resources in Ship Repair at Naval Shipyards, An*, by CDR Enrique M. Aedo, Chilean Navy (Monterey CA: Naval Postgraduate School, Sept. 1974), 95 pp. (DLSIE-CB)

This thesis provides shipyard planners with an aid to making their daily decisions about scheduling jobs and allocating manpower resources, while trying to accomplish each project within its schedule. A heuristic algorithm that focuses on the specific problems of the shipyard planners is developed, and included is a computer program that performs all the necessary calculations and gives the planners a daily assignment of resources. Four other allocation procedures are surveyed: two of these give solutions to the single project, multiresource problem (one procedure is an analytical model; the other, an empirical method); a third procedure is a heuristic approach to a multiproject, multiresource problem; and the last is an analytical model that applies to the single-project, single resource problem.

Six conclusions are reached:

- (1) Shop planners in shipyards need planning aids to help them make decisions about how to allocate their manpower resources each day while trying to maintain all job-completion dates without delay; or, provided that sufficient resources are available to perform all the required work, they need to determine what jobs should be postponed so as to produce the smallest overall delays.
- (2) The program has no limitation on either the number of projects or the number of resources that it can handle (provided the problem remains within the capacity of the computer).
- (3) The analytical models (summarized earlier) are felt to fall short of presenting useful answers to the shipyard planners.
- (4) The empirical method that is currently being used in some shipyards lacks flexibility and suffers in that it is really intended for the single-project, multi-resource case.
- (5) Scheduling with the modified empirical procedure is made on a weekly basis--reducing the ability of shipyard planners to react quickly to unforeseen problems.

(6) The computer program presented in this thesis is very flexible.

4. *Analysis of Critical Skills Shortages in Naval Shipyards*, by Booz-Allen and Hamilton (Bethesda MD: for Naval Sea Systems Command, Dec. 1974), approx. 50 pp. (IDA).

This report documents results of the initial phase of a planned four-phase shipyard productivity-improvement study, indicates the trades that are experiencing critical shortages of mechanics in Naval shipyards, identifies and analyzes the causal factors, and develops recommendations to improve the situation. Recommended actions to improve the critical-skills situation fall into three groups:

- (1) *Programs Currently in Effect at One or More Naval Shipyards* (e.g., increase in the use of women in critical-skills trades, use of high-school recruiting programs to get better quality input into the apprentice programs, better use of helper-to-journeymen programs to provide intermediate skill levels).
 - (2) *New Programs Not Requiring Changes to Civil Service Regulations* (e.g., use the worker/leader rating to the extent required and of talent available; structure a completely voluntary program to develop personnel with dual skills, such as shipfitter/boilermaker; implement the concept within the physical confines of a repair yard and the scope of a major repair/overhaul work package).
 - (3) *New Procedures Requiring Changes in Civil Service Regulations* (e.g., give the shipyard commander authority to designate personnel within critical-skills trades to be exempt from some reduction-in-force [RIF] programs).
5. *Annual Report on the Status of the Shipbuilding and Ship Repair Industry of the United States--Fiscal Year 1973*, prepared under the direction of Coordinator of Shipbuilding, Conversion, and Repair, Report Control Symbol DD-I&L(A) 1141 (Washington: Naval Ship Systems Command, Office of Maritime Affairs, Code 05D), approx. 75 pp. (IDA).

This report is compiled in accordance with DoD Directive 5030.9 (19 Jan. 1972), which requires the DoD Coordinator of Shipbuilding, Conversion, and Repair to "make an annual report

to the Secretary of Defense on the status of the shipbuilding and repair industry of the United States with conclusions and recommendations considered appropriate." Toward this end, this first issue characterizes the national shipyard-posture, reviews major events of the fiscal year, addresses both the interagency working relationship and the projected workload in the shipbuilding and repair industry, and provides some conclusions and recommendations resulting from the analyses. More specifically, the initial issue (in addressing the national shipyard-posture portion) includes an overview of the entire industry in terms such as numbers of vessels ordered, employment levels, dollar value of work, available employee skills, employee-skill shortages, principal features and characteristics of each yard, etc. The review of the year's major events fall into groupings such as (1) a list of the major studies and reports produced during the year regarding shipbuilding and (2) new laws and regulations affecting the industry. Characteristic of the types of conclusions drawn in the report are the following:

- The world situation is changing to the point that the United States may be capable of competing worldwide for some types of new ship construction and repair.
- Both private and Naval yards are having difficulty in expanding their labor forces to match expanding workloads.
- That various skill categories are in short supply is the greatest-single immediate limitation on the private shipbuilding industry.
- There is a need to expand industry-wide training programs.
- The problem of the widely fluctuating workload must be solved.
- The industry must expect longer component procurement lead-time.

Quoting a major report to the President, the report observes that the current commercial shipbuilding industry provides an

insufficient mobilization base for merchant ships alone--without even considering Naval ship requirements.

6. *Annual Report, Shipbuilders Council of America--1973* (Washington: Shipbuilders Council of America, March 1974), 36 pp. (IDA).

This annual report surveys first the American shipbuilding industry for the year in the broad context of its position in the world market, then activity in Naval and in merchant shipbuilding; reviews for the year Congressional legislative developments affecting industry management (i.e., procurement practices, industry earnings, types of material shortages, inflation effects); and cites a series of benchmarks achieved during the year.

In this 1973 issue, the overview demonstrates a record-breaking level of peacetime activity in the yards and swollen industry orderbooks that have been triggered by interest in world oil-product tankers and liquified-natural-gas carriers; it warns, however, of a potential overcapacity in foreign yards that will probably lead to intense world price competition in the years 1975-80. It notes also that 60 percent of the funds for Naval shipbuilding and conversion flows to the shipyard industry but that the only Naval ship program awarded in 1973 was for the lead ship of the innovative Patrol Frigate project. It states that four independent studies (two Navy-sponsored and two industry-sponsored) show that costs in Naval yards are higher than in commercial yards and, further, that Congress probably recognized this difference when it authorized a 10-percent increase in allocation of Navy work to private yards (i.e., the former 80/20 percent Navy/private-ship repair-workload split has been changed to a 70/30 split).

The Council reports that shipyard orderbooks in 1973 are dominated by energy-oriented vessels; and the Council expects that this dominance, as well as the trend to build ships of

increasingly larger tonnage, will continue over the next few years. The Council further observes that the cost gap between foreign and U.S. ship construction is narrowing and that the financing package offered for U.S. ships is substantially better than any offered by foreign yards. (See also the annual report for 1974; though only the latest issues have been abstracted, issues of recent prior years exhibit a similar pattern of content.)

7. *Current Status of Shipyards--1974*, U.S., Congress, House, Hearings [July-Oct. 1974] before the Seapower Subcommittee of the Committee on Armed Services, 93d Cong., 2d sess. (in 3 pts.: *Naval Shipyards*, *Private Shipyards*, and *Governmental Actions*) (IDA).

Part 1 presents testimony of Navy spokesmen concerning shipbuilding. They present the status of the U.S. shipbuilding and ship-repair industry (including various statistical arrays of employment, the composition and distribution of work, etc.). The emphasis is on Naval yards, but Navy relations with private yards are also addressed. Facilities, equipment, work, and personnel are described for each of the Navy's eight yards. The description is supported by extensive photo coverage. The Navy discusses its shipyard-modernization program and attendant planning. Finally, intelligence officers portray the status of Soviet shipbuilding, shipyards, facilities, and trends observed.

Part 2 contains testimony of representatives from the private yards. Each describes his yard's capabilities and programs of interest. They also air some of their problems with the Navy in the administration of the contracts and the handling of change orders and claims, problems they encounter in getting and keeping skilled personnel, the turbulence of ship orders and funding in the industry, etc.

Part 3 includes a summary of the Maritime Administration's program as it affects shipyards. The Chief of Naval Operations

gives his broad-gauged report on the status of the shipbuilding and ship-repair industry, construction and conversion programs, subsidies, the Navy's five-year shipbuilding program, allocation of work among available yards, and major problem areas that the Navy is encountering with shipyards and shipbuilding. The Secretary of the Navy, too, discusses Navy problem areas with shipyards. Finally, Admiral Rickover wide-rangingly airs his opinions and complaints about various aspects of DoD and Navy organization and staffing: the excess organization layers concerned with the administration programs, deficiencies in contract administration, the need for more emphasis on engineering education in various Naval billets, excess bureaucracy, etc.

8. *Destroyer IMMP (Integrated Maintenance and Modernization Planning) Feasibility Study*, by J. J. Henry Company (West Park Drive, Mt. Laurel Industrial Park, Moorestown NJ: for Naval Ship Systems Command, March 1974), approx. 100 pp. (incl. appendixes) (IDA).

The purpose of this study was to determine whether it is feasible to adapt the submarine IMMP program to specify those depot and intermediate-level nonnuclear maintenance actions that, if accomplished, will provide a higher degree of assurance in the reliability of components upon which any vessel is either mission- or safety-dependent. The IMMP program was originally applied to submarines to extend their overhaul-cycle period and, thus, achieve higher levels of operational status. As it became expedient (but safe) to extend the period between submarine overhauls and to shorten the actual overhaul period, the demand for a viable intermediate-maintenance system increased; and this study explores the practicality of applying this concept of intermediate maintenance to destroyers. The document provides extensive detail in identifying the types and quantities of essential and critical components, including estimates of their frequency of repair in submarines. Similarly, it shows the frequency with which those types of components appear in

destroyers and finds that there are sufficient numbers of critical components in destroyers that would be amenable to maintenance under this concept. In brief, the criteria developed as guidelines in selecting IMMP components for submarines were used in analyzing and isolating for destroyers the ship systems that require maintenance and that are essential to ship safety, operability, and mission capability.

The team identified component lists for six general classes of destroyer-type ships, involving 102 vessels. The report concludes: "The development of software, administration, availability of resources as well as annualized maintenance costs are sufficiently realistic, that we would consider the IMMP type program entirely feasible for destroyers."

9. *Engineered Long Range Modernization Program for the U.S. Naval Shipyards* (Washington: Department of the Navy, Naval Sea Systems Command, Dec. 1974-75), approx. 1,000 pp., FOR OFFICIAL USE ONLY (IDA).

The report consists (for each Naval Shipyard) of a set of volumes: an Executive Summary, the body of the report (i.e., vol. 2), and two appendixes--each bound separately.

In the early 1960s, the obsolescence of the entire Naval Shipyard complex was a threat to its mission of providing logistic support to the fleet. Based on results of a comprehensive industrial-engineering study by Kaiser Engineers, published in 1968 (q.v., below, under similar title), the Navy developed a modernization program to update its facilities, efficiency, and capability. Since then, both the size and composition of the Navy's fleet have changed radically (e.g., size reduced from 1,000 ships to little more than half that number); its shore establishment has also changed (i.e., two yards closed and important reassignments made). Updating the 1968 report, the 1974 report is based on the missions, tasks, functions, and workload projected for FYs 1976-89.

The main report for each yard describes (1) its mission,

tasks, and functions and the background of the portion of the Naval Shipyard Modernization Program applicable to that yard and (2) available facilities and plant equipment (together with recommended actions for modernization)--a discussion that proceeds under four general headings:

- Waterfront Facilities (analysis of piers and drydocks, from the standpoint of requirements and deficiencies).
- Facilities and Plant Equipment (analysis of facility and plant-equipment requirements for the individual shops).
- Utilities and Services (analysis of support elements for industrial needs).
- Support Facilities (i.e., the facilities and plant equipment needed for engineering/management, public works, quality and reliability assurance, supply training, cranes, service-craft, etc.).

10. *Examination of the Programs of the Navy Respecting Fleet Repair and Modernization, Aircraft Repair and Modification, and Base Maintenance and Repair*, by Donald C. Cook, Chairman of the Board and Chief Executive Officer, American Electric Power Company, New York NY, a personal report to Adm. Elmo R. Zumwalt, Jr., Chief of Naval Operations, The Pentagon, Washington DC (21 May 1974), 52 pp. (IDA).

This report, personally prepared by Mr. Cook at the request of Admiral Zumwalt, reflects results of approximately three months' examination of the Navy's policies and programs in three general areas: fleet repair and modification, aircraft repair and modification, and base maintenance and repair. As a frame of reference for viewing the maintenance problems, the author first supplies a broad outline of the types of maintenance; he next addresses the problems that arise from the nature of the budgetary process and its execution. For example, he observes excessive restrictions by Congress on the use of funds in operating appropriations and calls for allowing DoD more flexibility to reallocate funds within an appropriation. He suggests use of transfer authority within specific percentage limitations (say, three percent of any subdivision to another subdivision within

an appropriation) and suggests that DoD simply report concurrently to Congress the actions taken.

The author's comments concerning "Fleet Repair and Modernization" are of special interest: He (1) outlines how the Navy is organized to accomplish ship-repair and modernization activity and how funds must be apportioned between public and private shipyards, (2) faults the Navy for a lack of a budgetary procedure that truly recognizes a reasonably expected rate of inflation in its fund requests, (3) points out that the Navy's failure to recognize it in past years has limited the amount of work that the Navy could buy with the available funds, and (4) notes that, despite increased appropriations in recent years, the number of ships requiring overhaul and modernization (and included in the "bowwave") is now high--and can be expected to continue to remain high in the future. In all, Cook submits seven recommendations (of which the following are representative) for improving fleet maintenance and overhaul:

- Clarify the basis used in determining the work to be done (i.e., the nature and extent of the deficiencies) and the funds needed to eliminate the "bowwave."
- Establish a set of standards to be used in making the deferred maintenance determinations (applicable to the "bowwave"), and use these conclusions in establishing the priority of the work to be done.
- Give renewed and added emphasis to organization and intermediate maintenance (e.g., extend--not diminish--the role of tenders and repair ships).
- Give incentives to experienced Navy maintenance personnel to stay and, thus, avoid loss of these critical skills through personnel turnover.

Cook suggests that a large part of the overhaul problem results from the fact that the number of ships available is too small to carry out the Navy's assigned and necessary mission. As a result, it is practically impossible for yards to fix firm schedules for the start, progress, and completion of necessary ship maintenance and overhauls.

In similar fashion (though of less concern here), the report

addresses two other non-shipyard areas. In the aircraft-maintenance area, Cook shows that much better inventory control is needed for spare parts. In his review of base maintenance and repair (e.g., the condition of shore facilities), he points out the extensive deterioration of facilities that has occurred at the Oceana facility and cites it as an outstanding example of the evils of undermaintenance. He admits that these poor conditions at this master jet base (located in the area of Virginia Beach) is well known in Navy circles and universally deplored. The author suggests that the reason for the poor conditions is inadequate funds; but the reader is left with the impression that this state of disrepair is more the result of the Navy's set of priorities, which assigns a higher priority to alternative uses of the funds available.

11. *Impact of Performance of Varying Overhaul Schedules for the DDG-2 Class Destroyers*, by Atam Latchandani and Richard Morey (Palo Alto CA: Control Analysis Corporation, July 1974) (CNA-MOD).

The authors attempt a quantitative assessment of the change in performance to be expected if the overhaul cycles for the DDG-2 class of destroyers were altered; attempting to portray the costs as a function of time-since-overhaul, they examined historical data to get values for severe casualties for each destroyer. Because of the infrequency of such casualties, it was necessary to average data for all destroyers and to use a time-series approach to predict the occurrence of casualties, based on a sequence of observations at equally spaced, discrete time-points. The authors conclude that there is a need for more progressive maintenance after two years from the time of overhaul--as evidenced by all three measures of performance used; they also note that the length of the overhaul (now averaging 39.4 months) could be increased substantially (perhaps by 9 to 12 months) without significant further deterioration of ship performance.

12. *Industrial Management Review of Puget Sound Naval Shipyard*, General Accounting Office Report to the Secretary of Defense, no. B118733 (n.d., but prob. early 1974), 59 pp. (ID4).

GAO here attempts to show the effect on shipyards when the number of active ships in the Navy decreased from 917 in 1968 to 523 in 1973 and the number of shipyard employees decreased from more than 90,000 to less than 70,000 during the same period. The team found that managing shipyards efficiently is difficult--due to such limitations as the facts that shipyard management has no control over most of its workload, that use of berths and docks decreased sharply in this period, and that short-range workload is unpredictable and changes frequently. Such limiting factors have resulted in underuse of facilities and equipment; also, management cannot quickly adjust manpower for changes in workload and, accordingly, the direct labor force has become less productive. GAO concludes that, since the most critical constraint on shipyard operations is the low level and unpredictability of the workload, shipyard productivity is best improved by stabilizing and increasing the workload and by developing a viable means of balancing manpower requirements with the workload. The report offers a model to relate manpower consumption to dock and berth use for measuring facility use and overall performance. Specific recommendations are supplied to help resolve the problems noted--e.g.,

- Develop a program for accumulating data on the amount of time that equipment is actually in use.
- Reevaluate existing criteria for labor standards.
- Improve accumulation and processing of data for rework reports.
- Obtain active participation of shop management in the planning and estimating process.

13. *Maritime Subsidies*, Department of Commerce, Maritime Administration (Washington: GPO, May 1974), 160 pp. (IDA).

Published as a ready reference, this document gives terse summaries of the direct and indirect assistance that the nations of the world offer to their merchant fleets. This edition (replacing a smaller 1971 version) is the seventh in a series released by the Maritime Administration on the subject of maritime subsidies. The authors note that, almost without exception, governments of nations possessing merchant fleets (whether privately or state-owned) offer some form of special assistance to their maritime industries. The volume supplies for 50 maritime nations a digest of the maritime-related economic background and the available government aids within each country. Typical of the areas covered in the terse summary given for each country are the size and composition of its fleet, its foreign trade (in terms of total dollar values), type(s) of commodities hauled, and its trade partners. The country-by-country summary also identifies available financial incentives (e.g., operating, construction, and interest subsidies; trade-in allowances; loan guarantees; accelerated depreciation; cargo-preference schemes; cabotage restrictions).

14. *Naval Shipyard Performance Evaluation*, by Midn. Mark D. Frost, USN (Annapolis MD: Naval Academy, May 1974), 179 pp. (DLSIE-CB).

The powerful statistical tools of regression and correlation were applied to financial and operating data representative of the past five fiscal years, to determine functional relationships existing within the structure of shipyard operations. The application of sten scores to ratio analysis provided the means to focus managerial attention on the relevant factors of shipyard performance. A simple, easily understood format was designed so as to provide a quick and comprehensive picture of overall shipyard performance to assist management in the decision-making

process. Through the application of these statistical methods and analytical concepts (which have not been previously utilized), the efficiency and effectiveness of naval shipyard operations may be improved to provide lower costs to the customer activities of the U.S. fleet.

15. *Nuclear Merchant Ships*, sponsored by Office of Naval Research (Washington: National Academy of Sciences, National Research Council, April 1974), 138 pp. (DLSIE-CB).

Undertaken at the request of its sponsors, this study was made under the auspices of the Maritime Transportation Research Board (MTRB), National Academy of Sciences, National Research Council, as a part of a continuing program of advice to the Federal Government, directed toward improving maritime and maritime-related transportation. The question of a recommended strategy for the development of nuclear-powered merchant ships embraces a number of complex interrelated issues. Accordingly, a truly interdisciplinary panel representing the following areas of competence was required: nuclear-ship technology, naval architecture, marine engineering, transportation economics, operations research, advanced energy sources and propulsion technologies, nuclear physics, marine biology, maritime law, and ship financing.

The panel's major conclusions are that (1) nuclear power is not presently economically superior to, or even competitive with, conventional power for commercial ships and (2) there is great uncertainty as to when, or possibly even whether, nuclear power will become economically competitive for commercial ships. This uncertainty stems mainly from the difficulty of projecting bunker-oil prices for conventionally powered ships over the next 20 to 30 years--a period approximating the construction time (including securing the required regulatory-agency approvals) and the operating life of a nuclear-power merchant ship.

16. *Ocean Shipping Technology Forecast and Assessment*, by A. Wade Blackman, sponsored by Maritime Administration (East Hartford CO: United Aircraft Research Labs, July 1974), 1,300 pp. (NTIS).

This important and comprehensive report was published in five volumes: *Executive Summary*, (I) *Summary Report*, (II) *Technology Assessment Definition*, (III) *State of Maritime Technology*, and (IV) *State of Society and Industry*. Probably of most interest here is Volume II, in which the team first evaluates the current state of technology in the maritime industry and projects technological capabilities for the next 25 years--then evaluates the impact of the key maritime-industry sectors' technology in the future of the U.S. maritime industry and the nation. These evaluations include a quantitative-impact analysis of economic and social factors for the years 1975-85. The team developed action options and their consequences and analyzed the problems and constraints. Though this report focuses on U.S. ocean shipping, it has applications for shipbuilding/conversion/repair.

17. *Personnel of the Naval Shore Establishment*, NAVSO P-111 (Washington: Office of Civilian Manpower Management, Manpower Information Division, Navy, June 1974), 59 pp. (IDA).

This pamphlet supplies various arrays of the distribution of Navy civilian (also, in some cases, military) personnel--e.g., by Bureau Office, Command, and Field Activity; by geographical area and district; by occupation classification. It also includes various personnel profiles and summaries--e.g., numbers of (personnel) reductions-in-force, numbers of retirement actions.

18. "Problems Beset the Navy," by John T. Hayward, contributing ed., *Government Executive*, 6 (June 1974), 81-83 (IDA).

Reporting as a contributing editor for this magazine, the author notes that while Congress, the shipbuilding industry, and the Navy must all share the blame for the problems besetting the Navy's shipbuilding program, the Navy must accept most of the

responsibility. Too often, Hayward points out, the specifications put out by the Navy are defective and the builder does not know what he is supposed to produce; the Navy is faulted for its improper management procedures--which, if corrected, would "resolve the claims problem." He cites results of an Appropriations Committee staff report (aired in the 1972 Congressional hearings) that concluded: "The overall problems of the shipbuilding programs can be traced directly to poor management by Naval personnel concerned with such matters." The author further endorses that staff report by noting areas of deficiency in the Navy (e.g., officers' relative inexperience in the complexities of modern-day business; their rotation before learning their tasks; the absence of a single authoritative document prescribing policies to be followed in the financial management of the shipbuilding and conversion program).

Hayward recalls that since 1961 the Navy has cancelled 71 new ships and conversions for which Congress had appropriated \$1.6 billion. He feels the main reason for the cancellations were cost growth and claims; not inflation; he further laments that in 11 years the Navy spent \$23 billion for shipbuilding and should have more to show for this expenditure in terms of modern, sea-going, effective men-of-war. His impression is that the United States does not have a credible surface-ship capability at sea, compared to the USSR's. Citing several examples to support him, the author views the Navy's surface-ship category (and associated weapon systems) as "a real disaster area."

19. *Reducing the Costs of Navy AO Overhauls*, Phase II of the Ship Overhaul and Maintenance Study (SOAMS) project, by Herbert Mills, Gershon Cooper, and Bernard Samers (Stamford CO: Cooper and Company, 31 July 1974), 109 pp. (IDA).

Sponsored by the Office of Naval Research, this study develops an approach to the improvement of maintenance and overhaul of Navy ships, by establishing the causes of the large differences in overhaul costs that in other studies had been

shown to exist for tankers subject to different overhaul policies. Specifically, it compares overhaul to U.S. Pacific Fleet tankers, tankers operated by Military Sealift Command (MSC), and the tankers fleet of a major U.S. oil company (commercial overhaul). The team monitored preparation of work orders for overhaul by MSC and a commercial yard for two AOs (auxiliary, oiler) about to undergo regular Navy overhaul. The work to be done (and the applicable cost) was compared in detail with comparable work for a regular Navy overhaul. A similar comparison was made of a MSC overhaul of a transferred Navy AO and the Navy overhaul of two similar AOs operated under similar conditions. The report demonstrates that, at time of overhaul, AOs are generally in poorer physical condition than MSC/commercial tankers and that, for ships in the same condition, the Navy spends at least twice as much as MSD would spend and about five times as much as the commercial operator would spend. Much of the high cost of Navy work is attributed to the Navy's overhaul planning and implementation procedures. Accordingly, the consultant recommends changes in these procedures, as well as in AO overhaul policies (e.g., overhaul interval and budget).

20. "Seapower Subcommittee Testimony," memorandum by L. Sullivan, Assistant Secretary of Defense (Program Analyses and Evaluation), to the Deputy Secretary of Defense (23 Aug. 1974), 10 pp. (IDA).

This memorandum distills testimony that pertains to the Navy/DoD interface with private shipbuilders and that was given during July through September by spokesmen from the major private shipbuilding companies appearing before the Seapower Subcommittee of the House Armed Services Committee (see Item 7, above). The memorandum recapitulates the specific gripes aired by each spokesman. Mr. Sullivan further distills the comments by pointing out that all the formerly fervent desire of shipbuilders to do Navy work has dampened, in various degrees, because of the following practices:

- (1) The Navy's protracted decision-making processes (from program initiation, through technical details, to claims).
- (2) Harsh and/or ineffective procurement practices and procedures.
- (3) Unrealistic target costs and delivery dates.
- (4) Lack of a stable market.
- (5) Uneconomic contract terms and conditions.
- (6) Faulty product definition (specifications, change orders, drawings, etc.).
- (7) Complex Navy approval procedures prior to and during contract execution.
- (8) Delays in deliveries of Government-furnished information and material.
- (9) Interference with, and restriction of, shipbuilders' operating freedom.
- (10) Adversary roles between contractors and government.
- (11) Divided authority and continuous change of personnel.

Finally, he notes that all shipyard spokesmen agree that cost-reimbursement-type contracts should be used in the interim until reforms can be made.

21. *Ship Overhaul Cost Estimating Relationships (SOCER)*, INS Study 1034, by John Buchanan et al. (Arlington VA: Center for Naval Analysis, Oct. 1974) (CNA-MOD).

This study was undertaken to identify the factors that influence overhaul repair man-days and to ascertain how these factors can be used to predict future costs (for use in budget estimates). Analyzing the historical overhaul data presently used by the Navy to develop overhaul-cost equations, the authors attempted to improve on those methods and equations. The team examined three variables: overhauls, direct percent employed, and manning ratios. The authors say that, of the three, direct percent is the most problematic; hence, they explored alternative explanations of its relationship with repair man-days. The document notes that, at present, the procedure used to develop budget estimates is first to predict man-day requirements for a

particular overhaul, next to apply a projected man-day cost, and then to add an estimated material-dollars cost. Formerly, Navy budgeters developed their estimates in terms of dollars--not man-days. The study suggests that slight changes in the present estimating methods (including information contained in the SOCER equations) will reduce the underestimation of future repair man-days. The team recommends modification of the present budget estimating for overhauls, so that only the most recently available data are used as "baseline-ships," as opposed to the current practice of adding and subtracting so-called "unique" repairs (which, the authors suggest, should be eliminated). Further, the study suggests that estimators adjust their estimates for the age differences between the "baseline" and "overhauling" ships and recognize the effects of ship age in their estimates for out-years (used in preparing the Program Objective Memorandum). Finally, the authors recommend introduction of a system of post-overhaul inspections (including documentation) for conventionally powered surface ships. This new procedure, the authors promise, will substantially reduce the underestimates of ship-overhaul costs experienced in prior years.

22. *Shipbuilder's Guide to Federal Manpower Programs*, for Office of Advanced Ship Development, Maritime Administration, Department of Commerce (Washington: Mark Battle Associates, Inc., Dec. 1974), 23 pp. + appendixes (IDA).

Recently accelerated ship-construction activity has increased demand for craftsmen trained to meet manpower requirements in several critical shipbuilding occupations--particularly in shipfitter, welder, machinist, and pipefitter trades. Existing training programs, both in the shipyards and in the community, often cannot meet current or anticipated shipyard requirements for such skilled workers. This pamphlet demonstrates how shipyard training needs are frequently consistent with the goals of Federal manpower programs for providing job-training and employment opportunities. In brief, this pamphlet

offers a guide to Federally funded manpower programs to acquaint shipbuilding-industry representatives with the nature of these programs and how they may be used to meet the manpower needs of the industry. Further, it explains provisions of the Comprehensive Employment and Training Act (CETA) of 1973 and shows how it and other Federal programs (e.g., the Vocational Rehabilitation, Veterans Training, and Work Incentive [WIN] programs can provide many of the training and related services necessary to build the needed shipbuilding-manpower base).

It urges the shipyards to articulate their recruitment and training requirements for skilled craftsmen to the state and local agencies responsible for implementing governmental programs. Included is a listing of Department of Labor regional offices and state and local CETA prime sponsors.

23. *Shipbuilding Manpower Study*, for Office of Advanced Ship Development, Maritime Administration, Department of Commerce (Washington: Mark Battle Associates, Inc., March 1974), 144 pp., FOR OFFICIAL USE ONLY (IDA).

This study documents the dimensions of the manpower situation in three major shipbuilding regions: Atlantic Coast, Pacific Coast, and the Great Lakes. (A similar study of the Gulf Coast was done earlier.) In sum, the report (1) characterizes the current manpower status in 57 shipyards (in the three U.S. regions examined) and assesses within the shipyards the critical factors that influence the availability of specialized skills (including the impact of employee turnover, layoffs, wages and wage patterns, and training programs); (2) provides an analysis of the availability of skilled and semiskilled production workers by occupation, geographic area, and type of shipyard--also covered are critical external factors (e.g., area unemployment levels, Federal and State training programs, wages and weekly earnings in competing industries); and (3) forecasts industry requirements for skilled manpower through 1975. Data sources for the report are (1) replies to the survey from 57 shipyards,

(2) 20 State Employment Security Offices, and (3) other sources (e.g., Department of Labor, Bureau of Census, Maritime Administration). (N.B. Unlike the main report--FOR OFFICIAL USE ONLY--a separately bound 76-page *Executive Summary* presents results and conclusions without reference to employment data from individual firms.)

24. *Study to Determine the Annualized Maintenance Cost and Feasibility of Adopting an Extended Overhaul Cycle for Destroyer-Type Ships, A*, by Arinc Research Corporation (Annapolis MD: for Naval Ship Systems Command, March 1974), 66 pp. + appendix (IDA).

This study had a two-fold purpose: to determine, first, the annualized maintenance (repair only) cost for destroyer-type ships and, second, the feasibility of extending their overhaul cycle. The analysis consisted basically of determining whether there were economic advantages (to extending the interval) of material-readiness limitations. The team adopted the ground rule that, extended, the time should result in neither increased annual maintenance costs nor degradation of the material condition of the ships.

The analysis focused on examining the historical records relating only to corrective (repair) maintenance. These were divided into three general categories:

- (1) *Ship's Force/Tender Maintenance*, which consists essentially of the Maintenance Data Collection System (MDCS) data tapes.
- (2) *Overhaul Maintenance*, which was obtained from Shipyard Departure reports.
- (3) *All Other*, which includes cost data regarding all Restricted Availabilities, Technical Availabilities, etc.

The primary indicator used to determine the material condition of the ship was the trend of the Ship's Force corrective maintenance effort (expressed as maintenance man-hours per year) when it was related to the overhaul interval. These man-hours were analyzed both at the ship level and at the major-system level to

determine whether any of the systems were limiting the extension of the Repair-Overhaul interval.

In all, maintenance data for 102 destroyers were examined; but, for various reasons, this quantity was reduced in the end to a sample of 58 ship-maintenance histories. The 58 ships were divided into six classes; and, for each of these, the team examined the trends of cost and of material-readiness as functions of the overhaul interval. The team found that, for five of the six classes of ships, overhauls probably could be extended from a 36-month to a 48-month cycle--and, in some cases, to 54 and 60 months. Additional maintenance, however, would be required for each ship approximately 40 to 45 months after overhaul, to keep the ship in a desirable material condition.

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25. *Alternatives to the Current Shipbuilding Program*, by Jacob Kaplan and Richard Hatfield, summary report of a study done under contract to the Commission on American Shipbuilding (included as Annex IV to Vol. III of *Report of the Commission on American Shipbuilding*, Oct. 1973), 346 pp. (IDA).

The Commission engaged the authors in this study to develop and analyze candidate policy alternatives to that formulated in the Merchant Marine Act of 1970--i.e., progressive reduction (down to 35 percent) in construction differential subsidy-CDS-payments on U.S.-built merchant ships. Since this report forms an important contribution to the Commission's extensive report on shipbuilding (Item 41, below), it is deemed worthy of separate annotation.

The authors present 15 promising and sufficiently distinct programs that they developed for extensive evaluation. Some of the policy alternatives impact directly on shipbuilding by reducing U.S. shipbuilding costs or the cost to U.S. ship operators; others are designed to increase cargoes carried by U.S. flag ships, which in turn increase shipbuilding potential. Each alternative program (plus the present program) is discussed and evaluated in terms of a common set of criteria. The programs are examined in terms of their impact on the private sector (i.e., on shipping and shipbuilding) and are then reviewed in terms of their economic, military, and political effects. (These political effects include the impact on "cargo penetration," GNP, employment, U.S. balance of payments, Naval shipbuilding, mobilization base, cost to the U.S. Government budget, and political implications.) Among eight promising programs are titles such as--

- Introduce Flat Rate ODS (Operating Differential Subsidy).
- Assist Shipbuilders to Reduce Costs.
- Suspend Tax Deferment on Foreign Shipping and Negotiate Reduced Foreign Subsidies.
- Substitute Tax and Credit Incentives for ODS and CDS:
A Maritime International Sales Corporation With Tax and Credit Incentives.

- Use Quotas to Divert Regulated Commodities to U.S. Ships.
- Use Quotas but Eliminate CDS and ODS on Regulated Commodities.

Among 10 programs the authors considered unpromising are--

- Elimination of All U.S. Government Support.
- Offset Foreign Subsidies.
- Permit Foreign Ship Procurement.
- Shipment Quotas on All Imports.
- Government Build--Company Operate.

26. *Economic Impact of Recent Governmental Legislation on the United States Shipbuilding Industry, The*, by Todd Shipyards Corporation, New York NY, sponsored by Commission on American Shipbuilding, Washington DC (Feb. 1973), 100 pp. (IDA).

The authors of this report state that since passage of the Merchant Marine Act of 1970, significant and unanticipated requirements in the areas of environmental protection, safety and health, workmen's compensation and social security have resulted in substantial efforts and expenditures by shipbuilders in the United States.

The Commission on American Shipbuilding (sponsor for this report) selected Todd Shipyards Corporation to assess (and report its estimate of) the present and future cost of these requirements--particularly with their effect on cost and selling prices of present and future U.S.-built ships and the ability of the U.S. shipbuilding industry to achieve the specified Construction Differential Subsidy (CDS) levels stipulated in Public Law 91-469. In carrying out its task, the Todd team made a survey (to date) of the economic impact of changes in the areas of concern (cited above), noted the significant factors in each area, interpreted trends in costs, and projected the economic impact of the changes on the cost and selling prices of U.S.-built ships at least through FY 1976. The study team estimates that the

average base billing rate in the shipbuilding industry is roughly \$10 per hour and that this rate will increase by about 14 percent as a result of these changes. The components of this increase are shown to be (roughly) 5 percent for environmental legislation, 5 percent for safety and health, 3 percent for workmen's compensation, and 0.3 percent for social-security contributions. Adding these increases to predicted increased costs (due to environmental considerations) for steel, the team concluded that these unanticipated increases have already nullified the cost-effective action taken by the U.S. Shipbuilding Industry; and, in effect, they doubt that the industry can reduce the CDS level to the 35 percent (by 1976) stipulated in the Marine Act of 1970.

27. *Evaluation of Ship Overhaul and Maintenance Policy*, by G. R. Grainger et al., sponsored by Office of Naval Research, Arlington VA (May 1973), 83 pp. (DLSIE).

The primary objective of the Chief of Naval Operations' Ship and Overhaul Maintenance Study (SOAMS) is to define and evaluate various approaches to altering the Navy's current overhaul policies, in order to develop relationships between length of overhaul cycles, material-readiness condition, and overhaul costs. These relationships, then, provide the means for developing effective alternative policies that reduce the estimated resource requirements for overhaul and maintenance of Navy ships. Phase I of SOAMS encompassed a number of feasibility studies--each addressing a specific portion of the overall problem. The contractor's portion of the SOAMS is to describe (in as brief a fashion as possible) current overhaul policy. Expressed in terms both of "As Written" and "As Practiced" policy, these descriptions serve as a baseline with which various proposed alternative policies can be compared and evaluated.

28. *Gulf Coast Shipyard Manpower Survey*, for Maritime Commission, Department of Commerce (Washington: Mark Battle Associates, Inc., n.d.--but prob. 1973), 23 pp. (in Executive Summary; other vols. not reviewed) (IDA).

This pamphlet reflects results of on-site surveys at 19 shipyards along the Gulf Coast from Tampa FL to Brownsville TX. The survey was aimed at determining the nature and scope of the need for manpower training in specific skilled crafts (i.e., mostly welders and shipfitters) because of their importance in shipbuilding. More specifically, the authors attempted to document the need for training in specific skilled-craft areas and to determine the level of projected manpower needs in these areas over the next five years. The cumulative effect of expected manpower needs in the Gulf yards for these skill areas project a need for an additional 5,000 welders and shipfitters over the next 12 months--plus approximately another 5,000 replacements, or a total of about 10,000 during calendar year 1973. The report also includes brief summaries of results of several special studies undertaken by the team in Gulf Coast shipyards. These special studies focus on the parallel areas of manpower stability, training programs, and occupation, wage, and skill classifications.

29. *Management of Ship Overhaul and Repair Programs, Fiscal Years 1972 and 1973*, Report B-133170, by the Comptroller General of the United States to the Committee on Appropriations, House of Representatives (7 June 1973), 48 pp., FOR OFFICIAL USE ONLY (IDA).

During FYs 1972 and 1973, the Navy made substantial changes in its ship-overhaul program. Though the Navy received all the funds it requested in these years, it overhauled fewer ships than originally planned; and, because of this, the House Committee on Appropriations directed GAO to review that program. GAO found that actual ship-overhaul costs were 27 percent higher in 1972 than original Navy estimates and that, as of March 1973, the 1973 costs were about 20 percent higher than the original estimates. The original 1972 overhaul schedule of 139 ships was

reduced to 102 ships; and, for 1973, from 95 to 84. GAO supplies an elaborate discussion of what caused the differences. In brief, the discussion shows that the procedures used to forecast the number of man-days needed for overhaul were inaccurate, for the following reasons: generally, the man-days required for overhaul work were understated; some planned work was not included in the estimates; labor and material costs were allocated arbitrarily; prior overhaul costs, which were incomplete, were used to estimate future work. GAO also contends that the Navy's projections of man-day rates in Navy shipyards were substantially understated; further, that the most significant cost influence is the low use (in terms of their capacity) being made of the Navy shipyards. GAO calculations show that, when shipyard capacity is expressed as a function of shipyard employment levels, the 10 existing shipyards are operating at about 75 percent of their 1969 levels.

GAO shows that, in spite of a drop in employment from about 90,000 in 1969 to an estimated 67,000 at the end of 1973 (an approximate 25-percent decrease), overhead costs in the Navy yards have not dropped proportionately to the use; accordingly, the overhead cost per unit of production has increased. In words that are surely understatement, the report notes simply: "The Navy has changed its procedures for estimating the work needed when ships are overhauled. These new procedures, which appear to be improvements, were used to prepare the 1974 overhaul program."

30. *Minimizing the Cost of Projects in Naval Shipyards*, by Lt. Comdr. Norman John Shackelton, Jr., USN (Monterey CA: Naval Postgraduate School, Sept. 1973), 176 pp. (DLSIE-CB).

This thesis is concerned with a problem of scheduling that arises not only in Naval shipyards but also in many other organizations: minimizing the total cost of a project in which limited manpower is available from the various shops and in which the number of man-days to accomplish each activity in the project is

specified. (Total project cost consists of normal direct labor cost, overtime cost, and a penalty for exceeding some specified target date.) The mixed-integer model consists of several transportation problems linked by precedence relations. An application of dynamic programming to the single-shop case of the nonlinear model results in efficient solution procedures.

31. *Modular Ship Construction, State-of-the-Art Review*, by David Kupperstein (San Francisco: Hunters Point Naval Shipyard, July 1973), 68 pp. (DLSIE-CB).

This report contains a summary of representative reports and work done (and in progress) in the field of equipment and systems modularization--primarily for shipboard installation. Modularization of systems has been proposed for rapid and less costly modernization or conversion of both merchant and Naval ships. Proponents indicate that initial design and construction benefits may also accrue. A principal finding is that, with mission effectiveness held constant, modular ships will be at least 7-percent larger than the conventional ships; though modular ships will cost about 4-percent more to acquire, they will have conversion and modernization times and costs 20-percent less than those presently seen.

32. *Myth of Effective Management of a Shipyard Overhaul, The*, by Comdr. Marvin G. Smith, Jr., USN (Maxwell AFB AL: Air War College, Air University, April 1973), 22 pp. (DLSIE-CB).

The system of "shaved responsibility" for management of a shipyard overhaul is fraught with frustrations and ineffectiveness. This report assesses procedures widely used at present by destroyers in both the Atlantic and Pacific fleets and offers recommendations for integrating the ship-shipyard overhaul-management/work effort. Also, in view of rising costs in an all-volunteer Navy, the author raises the question of cost-effectiveness associated with retention of the ship's crew on board during lengthy overhauls.

33. *Naval Shipyard Base Structure Study* (Washington: Department of the Navy, Naval Ship Systems Command, Jan. 1973), approx. 200 pp., CONFIDENTIAL (IDA).

Herein, NAVSHIPS develops the Navy's plan for restructuring its Naval shipyard complex so that the size of each shipyard will be scaled to its future workload--based on the projections of the future size, composition, and homeport operating-area locations of the Fleet. In brief, the plan balances Naval-shipyard capability and capacity against projected Fleet requirements. The scope of the study is quite broad; it was conducted by a select team of NAVSHIPS personnel and directed by a Steering Group of senior officers representing NAVSHIPS, CNM, and CNO. The team was specifically directed to consider and analyze the following factors: strategic and operational requirements; homeport operating-base structure; forecasts of workload and available drydocks, shipyard size, and potential for shipyard expansion; and prospective ship technology, military-support facilities, role of the private shipyards, mobilization requirements, and cost factors.

The report includes an historical development of the industry and a summary of its current status (in terms of its capability, capacity, and utilization)--for both the Naval and private sectors of the industry. It first evaluates the Naval and private shipyard capabilities to meet the strategic and operational requirements established by the CNO; it then projects the capacity requirements through the 1980s and shows their impact on the industry. The report offers a series of alternative shipyard-base structures and estimates the potential savings offered by each in terms of dollars and personnel. It includes arguments for the relative economic merit of each alternative restructuring and/or suggested yard closing.

By design, certain yards are treated as "hardcore" yards, which are eliminated for various reasons from all closure alternatives; and for these the team assumes an increased tempo of modernization and additional investment in facilities and

equipment. Also, these yards are given increased workloading to reach their optimum capacity levels. Conversely, workloading at other (less desirable) yards is not allocated modernization funds, and they are given fewer workloads; therefore, yards become candidates for closure. Game planning eliminates excess capacity through suggested shipyard closures or continued selective modernization of the industrial plant. Ultimately, the optimum employment or assigned facility-capacity level approaches the gross peacetime planning level in each of the remaining Naval shipyards. Of several conclusions offered by the report, the following two are representative:

- (1) The latent capacity of both the Naval and the private sector of the industry will continue to be underutilized; hence, in the interests of efficiency and economy, certain Naval yards should be closed. (Various closure alternatives are selected and evaluated in the light of both capability and capacity requirements, as well as their effects on the economics of operation. However, for various reasons, some yards were excluded from all closure alternatives.)
- (2) The present Naval Shipyard Modernization Program must be restructured, the better to serve future Fleet needs.

34. *Navy Shore Establishment to Support the Notional Fleet* (short title: *Ships Support*), annex to a Naval Material Command Staff Study and Logistic Support Plan (*Shore Establishment Requirements for a Notional Fleet*, Report 1-73, 3 vols., 14 Dec. 1973), 175 pp., CONFIDENTIAL (IDA).

Though it forms only a portion of the larger report, only the annex prepared by NAVSEA 070 is annotated here. This annex focuses on the ship-repair capabilities and capacities of NAVSHIP facilities. Two independent (but related) analyses (1) show the time-phased requirements for the NAVSHIPYD complex and (2) identify the amount of excess or shortfall in the Navy's existing capability with respect to its strategic and operational requirements. An example of a strategic requirement is the CNO's designation of the need on each coast for two shipyards capable of repairing a specific type of submarine. An operational

requirement can dictate a specific yard to serve as a major homeport.

The Navy uses these requirements as the basis for its long-term planning and for determining the capabilities that its yards must possess. In making its capacity analysis, the Navy uses a Long-Range Planning System (LRPS) and a Shipyard Modernization System (SMS). The LRPS system produces a chronological projection of shipwork by ship type, type of availability, and estimated manpower requirements to perform each availability. The SMS system translates the LRPS ship-work projection for a shipyard to matching facility-, equipment-, and manpower-resource requirements.

Both private and Naval shipyard facilities are included in the analyses, though the focus is on the latter. The first analysis employs conventional planning techniques to identify the NAVSHIPYD complex needed to meet the strategic and operational requirements; the second uses a notional (or standardized) ship concept in distributing the workload to determine the capacity of the shipyards. To determine whether all the Naval shipyards are required, the team distributed first the expected workload to both Naval and private shipyards, then the *total* NAVSHIPYD workload to each NAVSHIPYD on the basis of its present capability and capacity; next, the team calculated the manpower needed and the time a dock (of proper dimensions) will be required to drydock each ship at the scheduled overhaul periods; and, finally, it analyzed the results. The report includes recommendations for realignments, consolidation of work, and adoption of a longer planning horizon.

35. *Organization of Shipbuilding Research Abroad and in the United States, The*, by D. M. Mack-Forlist and E. V. Lewis (Glen Cove NY: Webb Institute of Naval Architecture, April 1973), 107 pp. (AUTH-MOD).

The report surveys shipbuilding-research associations in Europe and Japan and presents a qualitative evaluation of their

effectiveness. Results of shipyard interviews and a questionnaire are used to survey the organization of the U.S. shipbuilding industry and to outline research needs. The authors recommend that high priority be given to management techniques and to personnel motivation and training and that the present cooperative shipbuilding-research program in the United States be strengthened by the creation of a senior central group or Shipbuilders' Research Association to work with R&D sponsors.

36. *Outlook for Production on the Navy's LHA and DD-963 Shipbuilding Programs*, Report B-163058, by the Comptroller General of the United States to the Congress (26 July 1973), 175 pp. (IDA).

Because of production and related difficulties at Litton's new automated shipyard, the General Accounting Office (GAO) examined the status of two of the Navy's largest shipbuilding programs (under contracts with Ingalls Shipbuilding Division of Litton Systems, Pascagoula MS), which are for series production of LHA (general-purpose amphibious assault) ships and antisubmarine destroyers (DD-963). The LHA program was the first Navy program undertaken by Litton in its new automated yard, and there was concern that Litton's management and production problems would adversely affect the follow-on DD-963 program. Most of the concern focused on the potential construction-slippage damage that one program could have on the other. In its report, GAO (1) observes that both Litton and the Navy substantially underestimated the problems involved in starting a new facility, obtaining an adequate work force, designing ships 2,000 miles from the construction site by a completely new organization, and using aerospace-production techniques; (2) outlines the points of disagreement between the Navy and Litton as to which is primarily responsible; and (3) categorizes the problems under the general heading of organization difficulties, contracting concepts, planning and control systems used, labor-force difficulties, cost, and schedule growth. Though it makes no

recommendations, the report summarizes for Congress some of the cost consequences of not only the withholding of funding for the cost growth already expected but also revised estimates of price escalation. The report warns about potential cancellation charges for the rescinding of orders for expected follow-on ships.

37. *Outlook for United States Shipbuilding in the World Market*, by Lester B. Knight and Associates, under contract to the Commission on American Shipbuilding (included as Annex II to Vol. III of *Report of the Commission on American Shipbuilding*, Oct. 1973), 86 double pp. (IDA).

Since this study forms an important data base for the Commission's much more extensive report on shipbuilding, it warrants this separate annotation. The Knight study synthesizes the competitive position of the U.S. shipbuilding industry, identifies the significant competitive factors, and supplies recommendations aimed at improving the U.S. position in the world market. It projects supply and demand through 1980 for the world shipbuilding industry (based on an analysis of major commodity groups--e.g., coal and grain--comprising the world-trade mix) and analyzes the major factors that affect world shipbuilding competition. Using statistics for a \$20-million hypothetical U.S. ship and seven actual vessels to illustrate the comparison on a more equitable basis, the report traces the components of shipbuilding costs by country of construction. The analysis not only includes the construction costs (i.e., basic construction cost, profit, subsidy, exchange rates, and price escalation) but also examines the expected opportunity cost of ships constructed in different countries (i.e., the cost of income lost due to differences in delivery times) and the cost of the financial package offered (i.e., financing terms, tax effect, depreciation allowances, and operating cost differentials). The report (1) supplies 19 important conclusions; (2) includes several pages of recommendations, in which the key requirement is shown to be that U.S. shipyards become competitive internationally;

(3) offers *specific* recommendations in the general areas of marketing, production, and government support (both financially and generally); and (4) suggests ways for achieving better shipyard/government cooperation.

38. *Overhaul of Self-Propelled Service Craft*, by Lt. D. R. Sawyer, USN (Norfolk VA: Navy Manpower and Material Analysis Center, Oct. 1973), 92 pp. (DLSIE).

This study identifies all work associated with a regular service-craft overhaul, identifies the optimum activity or echelon that should accomplish the various portions of a service-craft overhaul, recommends improved methods for accomplishing the required work, and identifies adequate supply support for the recommendations developed.

39. *Priority Ordering of Real Property Maintenance and Repair Projects*, by W. A. Barber et al. (Washington: Naval Facilities Engineering Command, June 1973), 163 pp. (DLSIE).

The purpose of this effort was to review a proposed rating system, comment on its consideration, and make recommendations for its use to establish an impartial priority-ordering of real-property maintenance and repairs projects for budgetary planning. As part of the review, comments from several activities of the system were obtained--as were quantifiable factors, which were then used to determine expenditure levels within general categories of shore facilities.

40. *Productive Work Accomplished by Ship's Force During Overhaul*, by Lt. Dale T. Hall, USN, et al. (Norfolk VA: Navy Manpower and Material Analysis Center, Atlantic, Dec. 1973), 48 pp. (DLSIE-CB).

This is a study of productive work accomplished by ship's force during overhaul performed on the USS *Lawrence* (DDC-4), the USS *Sampson* (DDC-10), and the USS *Bleknep* (DLG-26) as they underwent regular overhauls in Naval shipyards. The specific aim of

the study was to establish a solid baseline of the amount of productive work that can be accomplished by ship's force during a regular shipyard overhaul of a destroyer that is surface-missile-system configured. Phased maintenance during overhaul is discussed, and suggestions are given for improving the ship's force overhaul-management system. The report contains information about personnel utilization on each ship, breaks down the productive works into their components, and gives productivity/idle percentages.

41. *Report of the Commission on American Shipbuilding*, 3 vols. [plus summary; see above, Item 25] (Washington: Commission on American Shipbuilding, Oct. 1973), approx. 1,000 double pp. (IDA).

Established by the Merchant Marine Act of 1970, the Commission on American Shipbuilding had as its mandate four tasks:

- (1) Review the status of the American shipbuilding industry: its problems and its progress toward increasing its productivity and reducing its production costs.
- (2) Determine whether the industry can achieve by FY 1976 a level of productivity that will allow reduction of subsidy to 35 percent or less.
- (3) If not, then recommend alternatives to the ship-construction program in effect.
- (4) Suggest a course to improve the competitive position of the U.S. shipbuilding industry in world markets.

Volume 2 reflects the primary product of the Commission (while Volume 1 merely recapitulates the report, and Volume 3 presents selected studies and special papers either contracted for by the Commission or prepared by the Commission's staff). The report itself (as presented in Volume 2) first supplies the background of the legislation that led to the formation of the Commission and then describes the U.S. shipbuilding industry in terms of its resources and products--tracing its evolution and comparing it with other U.S. industries and with foreign shipyards. The report also discusses the trend of the productivity

of U.S. shipbuilding in comparison with foreign shipyards; in a chapter entitled "Shipbuilding Costs and Prices," it discusses the elements of the costs of shipbuilding, describes a typical shipyard cost structure, and compares costs of U.S. and foreign yard costs and prices--drawing attention to significant areas of government impact. Next, it examines the worldwide industry in the broad context of demand-and-supply probabilities and then (in a similar context, but including the additional effects of Naval shipbuilding requirements and unique national policies) the problems facing the U.S. shipbuilding industry.

The report grapples with factors that govern the U.S. shipbuilder's competitive position--first by synthesizing existing forecasts of domestic and foreign demand, then by describing (1) elements of shipowners' decisions to buy, (2) some of the existing and potential impediments to U.S. procurements, and (3) the effect of a few possible improvements in the U.S. position on the prospective demand.

Citing pitfalls in using the construction differential subsidy (CDS) as a measure of the competitive health of the industry, the report discusses the major variables affecting U.S./foreign ship cost-and-price differentials--emphasizing the factors that affect the forecast.

The Commission concludes that the present shipbuilding program is sound and that alternative programs are neither required nor desired; it suggests only slight modification to the present program--specifically:

- (1) Achieve some degree of market and transportation assurance by extending cargo-preference policy to cover all fuels imported from foreign sources by waterborne transportation.
- (2) Provide tax-deferred transfers of earnings from foreign-flag ships owned by U.S. corporations (or their subsidiaries) to U.S. corporations for deposit in capital construction funds for U.S. ship construction.

In preparing its final report, the Commission subcontracted some of its analysis to contractor study-teams. Some of those reports--in themselves major studies--appear as annexes in Volume 3. (Two of those studies were deemed worthy of--and are given--separate annotation: see Items 25 and 37, above.)

42. *Report on Survey of U.S. Shipbuilding and Repair Industry--1973*, by Department of Commerce, Office of Ship Construction, Division of Production (Jan. 1973), 74 pp. (IDA).

This report tabulates responses to the 1973 annual Maritime Administration (MARAD) survey of approximately 160 shipyards and ship-repair facilities. Primarily, the report presents various tabular summaries of the existing and available facilities for the construction or repair of ships; but it also includes capsule descriptions of manpower and general-facility data for major yards.

43. *Ship Overhaul and Maintenance Study--Application of Performance Monitoring Techniques to Shipboard Equipment*, sponsored by Department of the Navy, Office of the Deputy Chief of Naval Operations (Logistics) (Washington: Harbridge House, Inc., May 1973), 53 pp. (DLSIE-CB).

In October 1972, the Office of the Chief of Naval Operations initiated an investigation--called the Ship Overhaul and Maintenance Study (SOAMS)--to appraise the effect of the U.S. Navy's maintenance policies upon material readiness and overhaul costs and to seek for maintenance and overhaul new approaches that might reduce their costs. This particular study is concerned with performance-monitoring practices--i.e., the various techniques used to assess the condition of shipboard equipment without disassembly (and, concomitantly, to determine the need for maintenance). The study focuses on the management and economy of extending current practices, rather than on further development of the state of the art. The study concludes that a further extension is desirable and feasible and presents an implementation plan.

44. *Ship Overhaul Program, The*, Study 1002, by John E. Buchanan (Washington: Center for Naval Analyses, April 1973), 69 pp., CONFIDENTIAL (IDA).

This study examines major problems in the Navy's Program Objectives Memorandum (POM) for FYs 1974-78. In examining the ship-overhaul program for FYs 1969-72, Buchanan found that the Navy did not allocate sufficient funds to accomplish the ship-overhaul program and that it failed to anticipate increases in overhaul costs, which are observed to reflect higher-than-expected shipyard-labor costs and a change (in the mix of types of overhauls) to more expensive overhauls. Since budgets were underestimated, many regularly scheduled overhauls were deferred to subsequent years. The report points out that the Navy's projections for its overhaul programs in FYs 1973-78 still contain the same types of inconsistencies. The team estimates that scheduling policies call for two-thirds more overhauls than can be funded under the budget constraints of the Five Year Defense Plan and that, as a result, deferrals (which could lead to even higher overhaul costs per ship and reduced readiness in the fleet) will continue. The authors offer several alternative actions to obtain better utilization of funds and to arrest the growing backlog of deferred overhauls: extension of ship overhaul cycles, change in overhaul policies, allocation of more funds to the overhaul program, some realignment of Naval shipyards to achieve greater economies, reduction of overhead rates, and introduction of a procedure for estimating costs more accurately. The team offers its own computer model for estimating costs.

45. *Shipbuilding Research and Development*, by the Shipbuilding Research and Development Panel of the Ship Acquisition Committee, for the National Academy of Sciences (Washington: National Research Council, Division of Engineering, Maritime Transportation Research Board, April 1973; distributed by National Technical Information Services [NTIS], Department of Commerce AD 759 782), 164 pp. (incl. appendixes) (IDA).

This study is aimed at determining the R&D needed to accomplish the goals of the President's Shipbuilding Program, assuming that the primary goal is to assist the industry in achieving an internationally competitive position with a modest subsidy. The Panel observes that shipbuilding is caught in a vicious circle where its high wage rates and material costs eliminate it from international competition--which, in turn, results in a very limited market for U.S. products, whose volume then is insufficient to sustain long runs of standard ships, which would lead to economies of scale that translate to lower prices. The study admits that shipyards alone cannot achieve the goal, since half the cost of a ship is material supplied by component manufacturers. After describing the state of the shipbuilding industry and examining the low funding levels of current research, the report recommends expansion of the research toward achieving gains in productivity. It suggests that funding for this research should be allocated as follows: 35 percent to management research (e.g., centralized computer and computer aids to shipbuilding); 35 percent to labor (e.g., better understanding of the composition of the work force, reduction of labor turnover, and better training programs); 20 percent to a miscellaneous heading ("volume of business"), under which the study lumps such subjects as ship designs (including better propulsion systems) that achieve high productivity, improved marketing capabilities, better administration of subsidies, government-sustained excess capacity, and inhibitions resulting from antitrust laws); and, finally, 5 percent to facilities improvements (e.g., materials handling, welding, coatings, and surface preparations).

46. *Shipbuilding Research and Development*, by John H. Leeper et al. (Arlington VA: Office of Naval Research, April 1973), 178 pp. (DLSIE).

This report contains the analysis, conclusions, and recommendations of a multidisciplinary panel of experts convened to provide advice on the research and development to accomplish the shipbuilding goals of the Merchant Marine Act of 1970. The report covers organization, economic structure, and government relations in the shipbuilding industry--with an in-depth analysis of research and development. Conclusions and recommendations are provided.

47. *Statistical Analysis of Ship Maintenance Cost Incurred Between Overhauls*, by D. L. Castle, H. L. Eskew, and E. J. Ortlieb (Arlington VA: Office of Naval Research, July 1973), 51 pp. (DLSIE).

The researchers tested the feasibility of a statistical approach designed to describe the relationship (if any) between maintenance costs incurred between overhauls and the length of time between overhauls for Naval ships. Statistical regression analysis was performed upon two groups of ships (nuclear attack-submarines and nonnuclear aircraft-carriers). A set of possible explanatory variables (primary of which was the interval between overhauls) was tested in an attempt to discover functional relationship to predict the amount of intermediate maintenance-work required. Because of data limitations and the study size, significant conclusions were not attainable. However, the statistical approach was demonstrated to be feasible.

48. "Testimony of Vice Admiral Hyman G. Rickover," U.S., Congress, House, *Department of Defense Appropriations for 1974, Hearings before the Subcommittee of the Committee on Appropriations*, 93d Cong., 1st sess. (June 1973) (IDA).

The admiral's wide-ranging testimony (like that he has given in prior years) is hard-hitting and always makes interesting reading. Though he discusses many Navy-oriented problems, of

most interest here are his remarks (beginning on page 93) concerning shipyard deficiencies. Admiral Rickover observes that shipbuilding problems stem from the limited competition that exists for most major defense acquisitions, so that (with the help of claims) shipbuilders can operate profitably, regardless of their efficiency. As a result, he says, they have no true incentive to manage their work efficiently but, instead, spend much of their time seeking from the government more money in changes, claims, and contract repricings. He also notes that Navy representatives and Defense auditors have not been doing an effective job of administering Navy shipbuilding contracts and maintaining proper surveillance over Navy work. The admiral cites a series of deficiencies:

- (1) Shipyards generally have inadequately documented procurement files and no formal bid procedures.
- (2) Poor identification of material requirements has resulted in the waste and overbuying of material.
- (3) Cost-control and cost-reporting systems are inadequate, as are material-control procedures.
- (4) Overtime is not controlled properly.
- (5) Internal audit procedures are ineffective.
- (6) Auditors concentrate on verifying figures, rather than on evaluating shipyard functions from the standpoint of economy and efficiency.
- (7) Because costs are not collected for individual change orders, there is no way to verify the reasonableness of the prices subsequently negotiated for each change to the contract.
- (8) Overhead costs at shipyards are excessive, and controls on overhead costs are inadequate.
- (9) By taking a legalistic position in their dealings with the Government, two shipyards have bogged down contractual relationships in red tape.

49. *U.S. Industrial Outlook--1973: With Projections to 1980* (Washington: Department of Commerce, 1973), 450 pp. (IDA).

This annual summary presents a compact review of the year's developments in more than 250 industry groups. The compendium annually devotes about six pages of narrative and charts to the Shipbuilding and Repair Industry, the area of interest here. Typically, for the past few years the section titled "Shipbuilding and Repair" (prepared by the Maritime Administration) shows aggregated statistics from 1967 through the current year for such items as the value of work done, total employment, number of production workers, dollar value added, etc. A summary chart also "breaks out" work done on ships by type of ship (e.g., nonpropelled new ships, self-propelled new military ships, repair of military ships, etc.). Also included are such ship-industry data as the number of merchant ships and of Navy vessels under construction and on order in several general categories, the composition and distribution of the employment in the private yards, changes in the composition of the market (orders) for new ships, a brief summary of the Navy's funding for shipbuilding and conversion projects in the current year, a brief overview of recent developments in the industry, and discussion of results in some of the new technologies (e.g., welding, materials-handling capabilities, improved painting and surface-preparation techniques, etc.). The types of data presented are somewhat analogous to those of the *Annual Reports* published by the Shipbuilders Council of America.

50. *Workload-Leveling Computer Program for Use in Shipyard Planning*, by Jay Mandelbaum (Bethesda MD: Naval Ship Research and Development Center, Nov. 1973), 94 pp. (DLSIE-CB).

This report describes a program that performs workload leveling on ship overhauls within a shipyard. Done over a fiscal year, the leveling takes into account for each ship an independently provided, fixed monthly base workload and a unique scheduling range. A histogram of the leveled manpower

requirements (in man-days per day for each month of the simulated fiscal year) is part of the output generated. Also produced are the leveled productive monthly manning requirements by ship for each month of the simulated year. Newly assigned overhaul dates for each ship manipulated in the leveling process (and other descriptive input information) are also presented in the output reports.

1972

51. *Analysis of Shipyard Cost Reporting Systems* (New York: Society of Naval Architects and Marine Engineers, Sept. 1972), 21 pp. (DLSIE-CB).

This bulletin summarizes investigations into cost-reporting systems currently in use and presents a recommendation of a direct labor-cost reporting system in which a well-defined work package is utilized for reporting and control. The compatibility of this system with that outlined in DoD Instruction 7000.2 is also discussed.

52. "Analysis of the Ernst and Ernst Report, An" [see Item 75, below], under signature of the Commander, Naval Ship Systems Command Staff (March 1972), 21 pp. (IDA).

This NAVSHIPS rebuttal to Ernst and Ernst's report contends that--

- A major part of the Ernst and Ernst study is neither based on nor representative of a significant portion of the Naval or private shipyard complex.
- The study employs different bases for developing costs in Naval and private shipyards, with the result that private-yard costs are significantly understated in comparison with those of Naval yards.
- The study rejects the basic principle of incremental cost analysis, resulting in a misleading and unsupported impression of possible savings to be achieved by shifting work from Naval to private yards.
- The study employs a "value added" concept that is not only considered inappropriate for the type of analysis undertaken but that may also result in further understatement of private-shipyard costs in comparison to those in Naval yards.
- The study relies on unaudited responses by a limited number of private firms to financial and capabilities questionnaires.

(N.B. Item 64, a Booz-Allen Applied Research Study sponsored by NAVSHIPS, completed [later] in June 1972, employs incremental costing in its analysis of costs and supports some of the NAVSHIPS contentions about the Ernst and Ernst study.)

53. *Capacity and Capability of U.S. Private Shipbuilding Industry Through FY 1978*, The, Staff study in support of the Naval Shipyard Base Structure Study (Washington: Naval Ship Systems Command, July 1972), 23 pp., CONFIDENTIAL (IDA).

This study (1) addresses the question of whether private shipyards have the physical plant and the manpower necessary to meet the total demand in the ship-construction program through FY 1978, (2) describes separately (and in slightly more detail) the Navy's (SCN-funded) ship-construction program and the effects on the shipbuilding industry of both the Navy's SCN programs and its non-SCN work (i.e., repairs, alterations, conversions), and (3) supplies a terse profile of each of 13 major private companies (representing 18 shipyards in the United States), which construct most of the large ocean-going ships for both the Navy and other interests. These profiles characterize the types of work being done in each of the yards.

This document treats its subject curtly--somewhat in the form of a briefing. Essentially, it supplies some narrative around a series of charts and tables that recap planned shipbuilding and conversion programs and planned manning. For example, separate charts treat such subjects as the number of ships in the Navy Shipbuilding and Conversion Programs for FYs 1968-78, the end-cost value of those ships and the numbers of ships by ship category, actual/projected employment (i.e., total production employees per day) in private and public shipyards, the total annual dollar value of MARAD, commercial, and Navy repair programs. Little information is supplied in support of the data presented. Having examined the current workload and all projected programs through FY 1978, the authors conclude that the private shipbuilding industry has both the capacity and the capability to execute all demands placed upon it. Further, they (1) estimate that the current (1972) employment of 100,000 men will increase only about 18 percent (to a high of 118,000 production workers in FY 1978); (2) indicate that, on the basis of the Industry Evaluation Board's study, the private industry is

working at less than 40 percent of maximum capacity; and (3) discuss the capability of nuclear-oriented yards for both new construction and conversion work.

54. *Causes of Shipbuilders' Claims for Price Increases*, Report B-133170, by the Comptroller General of the United States to the Congress (28 Feb. 1972), 58 pp. (IDA).

Though contractors' claims for price increases have been a recurrent element in Navy shipbuilding programs, the problem in the few years prior to this report has worsened both in terms of size and as a percentage of shipbuilding contracts--totaling about \$1 billion. The claims are based on the proposition that the Navy owes the shipbuilders more than the contract price, because the Navy has failed to fulfill its part of the contract terms, generally in the following areas: (1) inadequate specifications, (2) tardiness in furnishing equipment and information it agreed to provide (or providing it in a form unsuitable for use), (3) adopted increased quality-assurance requirements beyond what could reasonably be expected, and (4) verbally requesting changes in a ship but failing to pay for such changes. A recurrent shipbuilder's gripe is the frequent inadequacy and/or tardiness of ship plans purchased from the lead yard. Since the Navy intended that such plans be purchased and used, it is contended (by follow-on yards) that the Navy should share responsibility for problems created by these plans. The GAO report notes that the Navy has undertaken an extensive shipbuilding- and conversion-improvement program, which includes a number of tasks intended to eliminate or minimize claims for price increases in future shipbuilding contracts; and the GAO believes that the actions being taken by the Navy have considerable potential for minimizing the claim problem. The only specific recommendation made in this report by GAO is the offer of a technique for eliminating the problems surrounding ship plans furnished by lead yards to follow-on yards.

55. *Considerations of Return on Capital Investment and Payment on Progress in the Defense Shipbuilding Industry*, by Lt. Comdr. Richard Earl Ames et al. (Monterey CA: Naval Postgraduate School, June 1972), 159 pp. (DLSIE-CB).

This thesis considers the impact of return on investment, progress payments, and cash flow in the shipbuilding industry. An examination was made of both government profit policy and contract financing as they relate to the shipbuilding industry. There was developed a computer model that makes explicit the discounted cash flow in a given contract and displays all government payments to the contractor as well as the contractor's share of contract financing. The time-adjusted rate of return that is implied by the terms and conditions of the contract is computed by the model. A decision process for computing a profit-negotiation position integrates (1) the industry Advisory Council profit-computation system, (2) the proposed shipbuilding progress payment method, and (3) the prevailing market conditions.

56. *Defense Contracting Policy: An Interface Mechanism With the Defense Industry*, by Lt. Comdr. George Neyman, USN (Newport RI: Naval War College, 1972) (DLSIE-CB).

This thesis presents a broad overview of the contractual relationship between the military and the defense industry, with emphasis on contracting trends and the impact of these trends on the nature of the defense industry--and shipbuilding in particular. The advantages and disadvantages of the contract types are discussed. From a profile of the defense industry developed from geographic, demographic, political, and national-priority factors, the nature of the so-termed "military-industrial complex" is examined and found to be real and necessary, but largely emotional when considered as a conspiracy against peace and society. Defense-contracting policy is found to be shifting from the cost-reimbursement to the incentive contract. Though the trend to contract incentives is found to be an improvement over earlier policy, it is not without disadvantages. (This thesis

is available to military and civilian governmental activities on a two-week loan basis from the Naval War College, Code 21.)

57. *Determination of Fleet Modernization Ship Configuration--FLTMOD*, Study no. 1001, by James Cotton et al. (Arlington VA: Center for Naval Analysis, Systems Evaluation Group, July 1972), 18 pp. + appendixes, FOR OFFICIAL USE ONLY (IDA).

The aim of the FLTMOD study was to develop a methodology for selecting the most efficient military alterations to be accomplished in ships within budget limitations during regularly scheduled overhauls. The candidate military alterations considered are for Military Improvement Plans (MIPs) and the Fleet Modernization Program (FMP). Specifically, the study was to determine current alteration-selection procedures, to examine alternative ways of allocating modernization funds for one class of ship (DDG), and to derive from this specific case a methodology for choosing the most desirable alterations from an assortment of proposals.

The report documents the current alteration-selection procedures, by describing the methods used by the Navy in assigning priorities to improvements proposed for active ships. It further provides an orderly procedure for analyzing and comparing large quantities of information about military-alteration alternatives in the fleet-modernization process. Though this procedure cannot be used directly for assignment of priorities to individual alteration, it does permit quantitative evaluation of total costs and qualitative assessment of benefits. Limitation of time and manpower resources for the study are said to bound results to (1) a suggested austere procedure for allocating modernization funds among various ship classes and (2) a procedure for evaluating proposed military improvements (PMIs) to ships. The study does not provide a way to determine the effectiveness of ships alterations. Therefore, to implement the alteration-selection process proposed in the study, or merely to improve the current selection process, a great deal of information about

ship-alteration effectiveness, cost, and technical feasibility must be accumulated.

58. *Distribution of Ungraded Employees by Trades and by Shops in the Naval Shipyards* (short title: *Trade Report*) by Productivity and Performance Evaluation Division (Washington: Department of the Navy, Naval Ship Systems Command, [Vol. 25] 30 June 1972), 124 pp. (IDA).

The report shows the number of employees at each Naval shipyard for each trade classification (e.g., armature winder, pipe-fitter, welder); and the number of planners, apprentices, and supervisory and nonsupervisory employees by shop for each of the yards; apprentices for each yard (by shop, trade, and year); and the distribution (number of persons) by trade classification within each shop within each yard. Other tables show the distribution of employees by the group in which the trade is classified (e.g., General Wage Service, Inspection Service, Printing and Lithographic Service, Ship Piloting Service).

59. *Influence of Unions on the Performance of the Public Naval Shipyards in the United States--A Positive or Negative Force, The*, by Comdr. William C. Wyatt III, USN (Washington: Industrial College of the Armed Forces, April 1972) (DLSIE-CB).

This paper examines union representation in the Naval shipyards, the current productive environment, efforts at performance measurement, and the influence of the unions on shipyard performance. Eight conclusions are reached:

- (1) Formal union organization has not substantially affected the performance of the Naval shipyards.
- (2) The complexity and critical nature of some of the work blocks some efforts to raise productivity.
- (3) Since precise measurement of productivity of customer work at Naval shipyards is not available, only subjective evaluations can be made.
- (4) Management bears a heavy share of the blame for poor productivity.

- (5) Union competition for recognition is disruptive and creates a more militant attitude toward management.
- (6) Union views have spread throughout the shipyard as ex-tradesmen have moved through the shipyard organization.
- (7) There has been insufficient training in management-labor relations in the shipyards at all levels.
- (8) The only significant union goals are greater union strength, higher wages and benefits, and job security.

(This thesis is available on interlibrary loan from the ICAF library.)

60. *Methodology for Evaluating Naval Shipyards, Phase I - Model Feasibility* (Washington: Logistics Management Institute, Feb. 1972), 39 pp. + 14-pp. appendixes (IDA).

This report describes work done in the first phase of a study requested by the Chief of Naval Operations. The study is aimed at development of a methodology and model for use in evaluating the relative utility of Naval shipyards (both in terms of cost and effectiveness) to show the impact of changing the number and/or capacity of those yards. In Phase I, for the purpose of selecting a model to use in further research, the team reviewed existing models and data. In Phase II, the team was to develop and test the selected model; but since it could find no model that would satisfy the requirement, further research was halted.

In all, the team examined four models, of which the first two were a scheduling-cost and a linear-programming model--both of which were rejected, because they lacked an essential element: a measure of shipyard productivity. The team concluded that construction of a measure of productivity for detailed models is impractical because of--

- (1) The nature of overhaul and repair work (i.e., it is large and complex; few jobs recur regularly and, when they do, work content varies widely).
- (2) The many constraints on shipyard operation.

(3) The differences among the shipyards themselves.

The third and fourth models examined were a total-cost comparison and a fixed-cost analysis, but both of these assume invariant productivity (which is considered to be an unrealistic assumption). More specifically, the total-cost model discriminates inadequately between costs of new construction in private and Naval shipyards and would require finding comparable packages of work in overhaul and in repair work. These data are considered unavailable. The fixed-cost model was rejected because it assumes that there are fixed (i.e., semivariable) costs of operating a shipyard that would be avoided by closing a yard. LMI's use of the term "fixed cost" applied to semifixed or overhead-type costs that are fixed only when viewed in the short term (e.g., management salaries, payroll processing, building maintenance). LMI observed that, in a period of decreasing workload, these overhead costs lag reduction in the direct workload but that, in a period of expanding workload, the increase in such burden accounts is nearly proportional to the increase in direct workload. These trends suggest to LMI that shipyards are managed so as to achieve some accepted overhead rate, and their impression was confirmed in informal conversations with shipyard management. The team concludes that burden is managed because there is no productivity or other standard available to evaluate performance; thus, shipyard-management attention focuses by default on what appears to be manageable--namely, the overhead rate. Accordingly, the team is skeptical of cost projections that are based on the assumption that total overhead costs for the complex of Navy yards would decrease by closing a yard. LMI's analysis of the actual costs incurred in the closing of the New York shipyard supports the team's position.

61. *Productive Work Accomplished by Ship's Force During Overhaul*, by Lt. Dale T. Hall, USN, et al. (Norfolk VA: Navy Manpower and Material Analysis Center, Dec. 1972), 48 pp. (DSLIE).

This is a work study of productive work accomplished by ship's force during overhaul performed on the USS *Lawrence* (DDC-4), USS *Sampson* (DDC-10), and USS *Belknap* (DLG-26) as they underwent regular overhauls in Naval shipyards. The specific aim of the study was to establish a solid baseline as to the amount of productive work that can be accomplished by ship's force during regular shipyard overhaul in a configured destroyer for a surface missile system. Phased maintenance during overhaul is discussed, and suggestions are given for improving the ship's force overhaul-management system. The report contains information about personnel utilization on each ship, breaks down the productive works into the components, and gives productivity/idle percentages.

62. *Relative Cost of Shipbuilding* (Washington: Department of Commerce, June 1972), 33 pp. (DLSIE-CB).

This report, submitted in accordance with Section 213(C) of the Merchant Marine Act (1936, as amended), is the annual report to the Congress on the relative cost of shipbuilding in the various coastal districts of the United States. The report considers and evaluates the extent of differences in material costs due to location, transportation, wage rates prevailing in an area, fringe benefits, utility costs, and climatic effects.

63. *Report of the Commission on Government Procurement*, 4 vols. (Washington: Superintendent of Documents [Stock no. 5255-00002], Dec. 1972), 800 pp. (IDA).

The Commission's objective was "to study and recommend to Congress methods to promote the economy, efficiency and effectiveness of procurement by the Executive Branch of the Federal Government." Its report reflects inputs from about 500 persons loaned to the Commission plus a staff of about 50 professional

members. The first three volumes contain an examination of the general procurement considerations plus separate treatment of the acquisition of R&D, major systems, commercial products, construction and architect-engineer services, and federal-grant assistance programs; the last volume addresses legal and administrative remedies, selected issues of liability, patents and copyrights, and other statutory considerations.

Though the entire report forms a valuable framework for understanding and examining the general procurement functions, probably of most interest here is that portion of Volume 2 that addresses the acquisition of major systems. The acquisition of weapon systems is viewed from the way the government organizes its policies and procedures to accomplish the steps from initial statement of need to the eventual use of the system. Volume 2 deals with the problems caused by the vested interest and motivation of the principal organizations in the roles they most often play in acquiring systems--i.e., it traces

- How over-optimistic contractors estimate their costs, performance, and delivery dates and make contractual commitments to win program awards.
- How the Services reinforce contractor optimism to gain large-scale but premature commitments.
- How agency heads lack effective means of control in discharging their responsibilities for coordinating components and programs in the face of severe bureaucratic pressures.
- How Congress and its committees have become enmeshed at a detailed level of decision-making and review in attempting to fulfill their responsibilities.

The report then demonstrates how the existing process disrupts programs, denies flexibility to those responsible for executing programs, and obscures Congress' view of related higher-order issues of national priorities and the allocation of resources.

The report suggests a program for establishing overall needs and goals for a new acquisition program and a common framework that highlights key decisions for all involved organizations--

Congress, agency heads, agency components, and the private sector. It defines (1) the role each organization plays in exercising its proper level of responsibility and control over acquisition programs and (2) a procedure for giving Congress and agency heads the information needed to make key program decisions and commitments.

64. *Study of the Relative Costs of Ship Construction, Conversion, Alteration, and Repair in Naval and Private Shipyards*, for the Naval Ship Systems Command (Washington: Booz-Allen Applied Research Inc., 30 June 1972), 140 pp. + appendixes (IDA).

This report combines two separate studies: the first provides for the years 1966-71 an historical comparison of the cost of doing shipwork in the Naval shipyards as opposed to private yards; the second, in effect, reflects a cost/volume analysis of each of the 10 Naval yards to provide a basis for the application of incremental-cost techniques. In brief, incremental costs focus on the change in the total cost of a yard associated with a specified change in volume of output. The report demonstrates the advantages in using incremental (versus total) costs for planning the estimated cost of alternative shipwork allocation among each of the various Naval yards--and, also, between the complex of Naval yards and the private sector.

Shipwork is treated separately under three categories: new construction, conversion, and repairs and alterations. Work completed in the period 1966-71 was analyzed in both technical and cost terms at the whole-ship and at the change-order level for new construction and submarine overhauls--but only to the job-specification level for regular overhauls and modernization programs of surface ships. The team's results are based on a sample of all 10 Naval shipyards and 10 private yards. The report identifies and provides a penetrating analysis of the principal causes for higher Naval-shipyard costs.

65. "Testimony of Vice Admiral Hyman G. Rickover," U.S., Congress, House, *Department of Defense Appropriations for 1973, Hearings before a Subcommittee of the Committee on Appropriations*, 92d Cong. 2d sess., pt. 9 (May 1972) (IDA).

In recent years this committee has annually called on the admiral for his views and comments concerning a wide range of subjects that, in general, fall into three general categories: Naval ship acquisition, shipyards, and the status and planned use of nuclear power in the Navy. Most of this year's testimony deals with nuclear ships. Of interest here are his remarks concerning shortcomings in the management of ship acquisition-and-repair programs for the Navy and his thoughts for streamlining the acquisition process. In its published record of the hearings, the committee includes citations of Rickover's correspondence and, sometimes, copies of the correspondence he prepared concerning shipyard deficiencies, Navy administration of shipyards and ship-building contracts, excessive use of overtime, and observed poor productivity in shipyards.

As in prior years, he also touches on--and voices his displeasure with--various aspects of the ship-acquisition process. Some specific areas he cites are

- Overstated contractor claims (with examples).
- (Over) concentration of shipyard management on profit rather than on supplying quality work.
- Navy's treatment of ship-contractor's claims.
- Difficulty in determining the reasonableness of shipyard contractor's charges to the Navy.
- Lack of effective legislation in the area of systems acquisition.
- Industry influence on defense-procurement policies.
- Poor management of shipyards.
- Excessive layers of organization in the Navy.
- Deleterious effects of the lack of continuity in Navy's administration of contracts (caused by rotating of Navy personnel).
- Excessive use of overtime in shipyards.

- Extensive idleness and loafing in shipyards.
- Excessive numbers of people in shipyards (with examples).
- Lack of a real need for highly automated shipyards in building warships.

66. *U.S. Merchant Fleet--Patterns for the Seventies, The*, by Lt. Comdr. Glenn E. Whisler, Jr., USN (Newport RI: Naval War College, 1972) (DLSIE-CB).

This is an analysis of recent U.S. maritime legislation, to predict the possible effect it may have on U.S. Merchant Fleet growth patterns for the 1970s. Limited to the shipbuilding industry, the investigation is concerned primarily with government incentives that are provided to both shipbuilders and shipowners to stimulate new building programs. The study finds that, as a result of new maritime legislation, the U.S. Merchant Fleet will experience a healthy growth during this decade. Depending heavily upon standardized ship designs, the prospective fleet will contain an ever-increasing percentage of large containerized carriers. The study concludes that the Merchant Marine Act of 1970 will be a giant step toward restoring the nation to the ranks of a first-rate maritime power. Recommendations to help promote more shipbuilding and to provide expanded markets include extending construction subsidies to certain ships that may not initially operate in U.S. ports. (This thesis is available to military and civilian governmental activities on a two-week loan basis from the Naval War College, Code 21.)

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67. *Acquisition of Major Weapon Systems*, Report B-163058, by the Comptroller General of the United States (18 March 1971), 84 pp. (IDA).

Aimed at providing Congress with an independent appraisal of the complex problems associated with weapon-systems development and procurement by DoD, this GAO report notes that the most important unresolved problem in the management of major acquisitions is organization: the Services attempt to combine the specialized roles of the management of weapon-system acquisition into traditional military-command structures, and the present structure leads to a large number of organizations (not directly involved) that can only negatively influence the project. GAO suggests that there should be a direct relationship between the mission for which weapon-systems requirements are determined (e.g., strategic deterrent, ocean control) and the organizational structure needed to acquire them. Such an arrangement would facilitate the grouping of related weapon systems in packages of a common mission and would permit putting together an acquisition organization of appropriate size and stature to handle these matters. The report demonstrates how a delay in the delivery of a new sonar system delayed the Navy's shipbuilding schedule because each weapon system on a submarine had its own project manager in the Naval Systems Command. GAO observes that the acquisition process must provide for someone to be in charge, to have authority, to make decisions, and to have full responsibility for the results. GAO suggests that the Secretary of Defense--

- (1) Perfect a DoD-wide method in which all Services determine the weapon systems needed in relation to the Department's missions; and establish the priority each system should have in relation to other systems in their missions.
- (2) Establish guidelines and standards for the preparation and use of cost-effectiveness studies.
- (3) Place greater decision-making authority for each major acquisition in a single organization within the Service concerned; and give it more direct control over the operations of weapon-systems programs and sufficient

status to overcome organizational conflict between weapon-system managers and the traditional functional organization.

- (4) Ensure that each Selected Acquisition Report (SAR) reflect these relationships.

GAO acknowledges that though some sort of priority-ranking system already exists, its value has not been proven. An indisputable priority is established weapon-system-by-weapon-system through the annual budget review cycle; however, these budget-derived priorities are not converted into a DoD-wide priority rating that would also determine each program's relative priority for *all* critical resources. Further, there is not effective connection between these budget decisions and some longer-range view that contracts each potential acquisition against a master plan of overall mission requirements and that is available for planning and developing the capabilities of all the Services.

68. "Anatomy of Shipbuilding Management," interview with L. C. Ackerman, *Government Executive*, 3 (May 1971), approx. 4 pp. (IDA).

Scott McDonald, executive editor for *Government Executive*, summarizes an interview with L. C. "Budd" Ackerman, president of Newport News Shipbuilding and Drydock Company, the largest private yard building ships for the Navy. Like some others who have examined the shipbuilding industry, Ackerman concludes that it has lacked adequate management-information systems and controls--as well as long-range planning. The Newport News yard was no exception; even though it had long-range contracts, it lacked planning on how to go beyond the current contracts. Ackerman voices a number of surprises in his new job:

- The massive difference in dealing with the government, as distinguished from being a supplier to private industry.
- The complexity of the business--even though it may not include the high proportion of advanced technologies of a moon shot.

- His frustration in not being able to solve the common sight of idle workers awaiting completion of segments of a job that must be done serially.
- The extent of over-regulation of the industry and the complexity of the procurement process--which he insists must be simplified.

Ackerman does not feel that his view on government regulation reflects merely a biased shipbuilder's evaluation; rather, it is offered after an objective view of the entire situation. Finally, he sees little hope in the near time period (i.e., 10 years) of getting the cost of the U.S. shipbuilding labor-hour anywhere near equal to that in competing foreign yards.

69. *Inventories at Naval Shipyards--Excesses and Improvements Made, Department of the Navy* (Washington: GAO, May 1971), 36 pp. (DLSIE-CB).

The General Accounting Office (GAO) examined supply management practices at four Naval shipyards: Puget Sound, Philadelphia, Mare Island, and Pearl Harbor. Industrial-material inventories at these four shipyards were about \$59 million (or 53 percent of the total of all shipyards). GAO found that there was no known need for 30 percent of the inventory at the four yards reviewed. This excess material (valued at over \$17 million) had not been reported to the Naval Supply System for possible redistribution to potential users or, if no longer required, for disposal.

70. *Naval Force Levels and Modernization: An Analysis of Shipbuilding Requirements*, by Arnold M. Kuzmack (Washington: Brookings Institution, March 1971), 47 pp. + appendixes (IDA).

As of 1971, more than a third of all U.S. Naval vessels afloat (built during the Second World War) will have to be retired over the next five or ten years. This paper addresses implications of the fleet's growing obsolescence and notes that expenditures for Naval ship construction in recent years have not been considered adequate to replace them. It is further noted

that the federal budget for Naval shipbuilding and conversion for FY 1972 was \$3.3 billion, a 27-percent increase over the budget for FY 1971. In this framework, the author attempts to portray what these funds plus funds in future years will buy in terms of Navy force levels. To demonstrate the relation between Naval force levels and shipbuilding budgets in the years immediately ahead, he constructs three alternative force levels. Kuzmack reiterates the rather obvious (but apparently not fully recognized) point that the required level of shipbuilding cannot be determined without deciding on the expected size and composition of the future Navy. He points out that, unless it makes a clear choice now, the Navy faces continued inconsistency between its shipbuilding plans and its approved force levels. In the meantime, its force increases in obsolescence (concentrated in the fleet-support vessels) and decreases in effectiveness. Kuzmack demonstrates the actual budget levels needed for the three reasonable alternative force-levels he has constructed in detail. He believes that his detailed analysis and linkage of shipbuilding requirements to alternative force-levels has not appeared earlier in the public literature. Not recommending a preferred force-level, Kuzmack only broadly covers the strategic issues involved in setting the size and composition of the Navy; but he supplies a brief summary of the public debate on these issues.

The document forms a good framework for understanding and viewing the implications of the current trends in shipbuilding and their impact on the composition of future fleet. For example, the writer notes that, though shipbuilding accounts for only about 10 to 15 percent of the Navy's total budget, it largely determines the future size and shape of the Navy; hence, the decisions on the number and type of ships to be procured have major future-budget implications for operating costs and required support forces.

71. "Problems and Prospects of the United States Shipbuilding Industry," by Ellis B. Gardner, Jr. (Newport RI: Naval War College Review, Oct. 1971), 8 pp. (DLSIE-CB).

The author, who is senior vice-president of Litton Industries, presents an overview of U.S. shipbuilding that includes a discussion of the industry's ability (or lack of it) to compete in world markets with shipbuilders of other nations. The industry is in for a decade of dramatic change and strange anomalies: it will be a period (1) when the contract definition of procurement will come under fire even before its fruits have been fully realized, (2) when U.S. ship contracts will be the highest since World War II (yet shipyards will go out of business), (3) when the advance of military technology will create a major problem in configuration for management, and (4) that will result in cost parity among United States, European, and Japanese yards that will allow U.S. shipbuilders--who survive the decade--to compete effectively in the world market of the 1980s.

72. *Service Groups of Naval Shipyards: An Industrial Engineering Study*, by Ralph M. Parsons Company (Los Angeles: Naval Ship Systems Command, 1 July 1971), 46 pp. (in *Executive Summary*) (IDA).

This study was administered by the Western Division of the Naval Facilities Command. The contractor's study team surveyed three West Coast Navy shipyards--Long Beach, Mare Island, and Puget Sound--to determine and define the facilities, workload, and manloading at those yards. Their report divides Naval shipyards into five main shops (i.e., woodworking, paint, rigging, foundry, and temporary services). These shops, in turn, are divided into 19 Functional Work Groups (FWGs). For example, the woodworking shop has five FWGs: boatshop, docking, plastic shop, inside mills, and outside mills. For all these service groups, the team defined the interrelationships--both within and among each. The definitions include the organizational structure, the products and services, processes and methods, equipment and

space, manning, etc. These data were then used in developing an idealized plant layout of the space allocations, equipment complements, manpower, process flows, and functional-flow recommendations. The team also developed a methodology for applying their model to the Long Beach yard, as a pilot.

The model uses the FWG as its basic building block. That is, each FWG is treated as a modular entity (wherever feasible) for which equipment, space requirements, and manpower were determined on an individual basis. This approach capitalizes on NAVSHIP's methodology and project planning, as set forth in the contract Scope of Work. The team based its estimates of projected shipyard-workload requirements on NAVSHIP's data for the model Design Notional Ship Level (DNSL) and the Notional Ship Unit (NSU).

73. *Study of the Navy Ship Maintenance Program*, vol. 1: *Destroyer Maintenance*; vol. 2: *Measures of Effectiveness of Ship Maintenance Policy*, rev. ed. (Washington: Logistics Management Institute, March 1971), 116 pp.; 33 pp. (DLSIE-CB).

Volume 1 contains the results of an analysis of maintenance and operational data (including overhaul costs) of 171 destroyers. The primary objective of this two-volume study was to find a material-condition index to serve as a measurement scale by which the effect of alternative maintenance policies could be measured. If an index could not be found, a secondary objective was to define the characteristics of a new index and to evaluate the need for it. An index could not be found in available data. That is, at no point in the operating cycle could the material-condition of a destroyer be located in a quantitative scale. While the first objective of the study was not met, it is believed that the analysis has been useful in describing and quantifying the effects of some operating parameters on maintenance costs.

Volume 2 discusses the efforts to meet the secondary objective. It addresses material condition, its relationship

to operational readiness, and the implications of the design of a material-condition-measurement system and its characteristics.

74. "Supply Viewpoint of SFOMS, A," by Lt. Comdr. R. L. Schlenker, USN, in *Navy Supply Corps Newsletter* (Washington: Department of the Navy, Supply Systems Command, 09D2, Feb. 1971), 3 pp. (DLSIE-CB).

The author briefly discusses the Navy's Ship's Force Overhaul Management System (SFOMS), which is designed to shift from a planned maintenance system to a production overhaul-management system to ensure effective utilization of all resources and ensure the completion of all necessary work.

75. *Survey of Cost Differentials and Other Factors--Private Versus Naval Shipyards*, by Ernst and Ernst (Washington: Shipbuilders Council of America, Nov. 1971), approx. 55 pp. + appendixes (IDA).

This study measures the *total* cost differential between work performed in private/Naval shipyards by comparing the number of man-hours expended on selected ships, mainly on destroyer (DLG) conversion programs. For the selected sample of work in private and Naval shipyards, the team compared the cost per man-hour of effort, based on assessment of the value added per production-worker-hour. An incisive and penetrating analysis is presented. After various adjustments to available data (to enhance comparability of the cost comparison), we are shown that a Naval yard expends 39 to 52 percent more man-hours than a private yard in accomplishing a similar job and that an hour of a productive worker's time costs 49 percent more in a Naval shipyard--resulting in a combined cost differential, estimated conservatively at 109 to 124 percent. The main conclusion is that it costs over twice as much to perform work in a Naval shipyard.

The study team observes that private yards assess their capability (with support from contractors, as necessary) much higher than do Navy officials. Included in the cost comparisons

are assessments of such indirect costs as Civil Service retirement costs, only a portion of which is currently recognized (and only that portion is included in the report's cost comparison). Actually, Civil Service retirement costs are about double the amount recognized (i.e., 28.7 percent of payroll, instead of about 14.9 percent) so the differences reflect a future unfunded liability. (N.B. See Item 52, which contest these Ernst and Ernst conclusions.)

76. "Testimony of Vice Admiral Hyman G. Rickover," U.S., Congress, House, *Department of Defense Appropriations for 1972, Hearings before the Subcommittee of the Committee on Appropriations*, 92d Cong., 1st sess. (11 May 1971) (IDA).

Of interest here is that portion of the admiral's testimony regarding the administration of shipbuilding contracts. Rickover reiterates his long-standing concern for the blatant inefficiency he sees among shipbuilders and, conversely, the government's failure to correct the problems in administering shipbuilding contracts. Some of the deficiencies he mentions are that--

- Shipyards lack effective means of cost control.
- Government representatives are being denied (1) access to financial records needed to determine reasonableness of costs charged to Government contracts and (2) review of overall efficiency of shipyard operations.
- Contractors are not complying with the Truth-in-Negotiations Act.
- Government is making an excessive and unwarranted number of sole-source procurement contracts.
- Shipyards are executing interdivisional procurements within the parent corporation without informing the Government.

At the request of the committee, the admiral introduces into the record several reports that he had prepared and sent to his superiors. These reports give his specific findings concerning

- (1) Overhead costs on Navy shipbuilding contracts.
- (2) Investigation of deficiencies in procurement and cost control at a large private shipyard.

- (3) Excessive profits paid on submarine-overhaul contracts.
- (4) The need for effective cost controls at commercial yards.
- (5) Deficiencies in the procurement of nickel-alloy materials at the Navy's largest private shipyard.

77. *Too Many Crew Members Assigned Too Soon to Ships Under Construction, Department of the Navy* (Washington: GAO, Aug. 1971), 36 pp. (DLSIE-CB).

The Navy assigns nucleus or skeleton crews for temporary-duty periods up to six months to ships under construction to ensure delivery of ships with trained, well-organized crews. Since the assignment of nucleus crews of experienced personnel to ships at construction sites involved a significant amount of valuable manpower, and since the payment of per diem to these crew members while they are on temporary duty increases ship-construction costs, the General Accounting Office (GAO) examined into whether personnel assigned to these ships were being used efficiently. GAO concluded that the Navy has not evaluated nucleus-crew work-requirements to determine needed ratings and rates. The assignment of personnel to nucleus crews is based on personnel judgment and historical practice rather than on established need. As a result, more manpower is authorized for nucleus crew than is needed to perform presently assigned functions. Some assigned functions might be better performed by personnel other than the nucleus crew, because dual responsibility exists for some of these functions.

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78. *CSMP and Material History Evaluation*, by Chief Electrician's Mate J. F. Winings, USN, and Chief Shipfitter R. A. Taylor, USN (San Diego CA: Navy Manpower and Material Analysis Center, Pacific, Dec. 1970), 40 pp. (DLSIE-CB).

This study critically examines the automated current ship's maintenance-data-collection system, to evaluate the validity of the system and suggest improvements that are deemed advantageous. The study contains recommendations for improvement of the current ships' maintenance project, which will provide for an automated work package for shipyard overhaul and improve its usefulness as a management tool.

79. *Case Studies in Computer Simulation: Systems Analysis of the Management Information System/Computer System, Long Beach Naval Shipyard*, by A. M. Feiler, sponsored by Office of Naval Research (Los Angeles: Univ. of California, March 1970), 33 pp. (DLSIE-CB).

The report describes application of the general-purpose computer simulator (Transim IV) to systems analysis of the Long Beach Naval Shipyard computer system, operating under the shipyard's management-information-system workload. The computer-system model is described and, to serve as a demonstration example for further problem-solving applications with the model, results are given for a representative simulation analysis.

80. *Development of Shore Manning Documents (SHMD's) Using the Operational Audit Measurement Method*, by Allen Byspiel (San Diego CA: Naval Personnel Research and Development Center, Nov. 1970), 251 pp. (DLSIE-CB).

This report documents the development of shore manning documents (SHMDs), a new concept in determining and documenting Navy manpower requirements (military and civilian) for shore activities. Requirements for better manpower-determination tools, Navy guidance, and related manpower systems are given. Reasons for the selection of the operational-audit-measurement method as the primary means for determining Naval manpower

requirements are provided--along with discussion of Navy-wide related data systems, development of a SHMD format, and specially designed measurement-study forms. The four phases of developing a SHMD are explained (there are also two follow-up phases).

81. *Drydocking Concepts and Features for Naval Shipyards*, sponsored by Naval Ship Systems Command/Naval Facilities Engineering Command (Los Angeles: Ralph J. Parsons Company, Oct. 1970), approx. 1,500 pp., FOR OFFICIAL USE ONLY (IDA).

This industrial engineering study was done in two phases. Results of Phase I are reported in a 500-page volume subtitled *State of the Art and Evaluation Methodology* (Dec. 1971). In Phase I the study team accomplished three objectives: they--

- (1) Categorized all present and future Naval ship types into a practical number of categories with respect to their drydocking needs.
- (2) Assessed the present drydocking facilities state-of-the-art, both foreign and domestic, applicable to the nature and scope of industrial activities done at Naval shipyards.
- (3) Developed a methodology for selecting the optimum facility for a proposed industrial mission.

Results of Phase II of the study are presented in a series of volumes: *Drydock Period Analysis* (7 July 1972) reports on the drydock periods required to perform regular overhauls and on potential ways to reduce these times. (The drydock-period analysis considers only the complex ship classes DLG, CVA, SSN, and SSBN). Six separate volumes, Books A-F, each contains the workload projections and recommended drydocking facilities for six specific shipyards. Another volume--subtitled *Free Horizontal Access Effects on Drydock Shipwork Efficiency* (Dec. 1971)--reports on a supplementary study effort of the team. In a volume titled *Drydock Expansion Potential Study*, the consultant outlines the most feasible expansion plan to accommodate increased drydocking capability.

One might characterize this report as the current definitive study of Naval shipyard facilities.

82. "Influences on Naval Ship Cost Estimating for Budget Purposes," by G. H. Main and J. A. Fetchko (Washington: Office of the Assistant Secretary of Defense [Systems Analysis], March 1970), 25 pp. (DLSIE-CB).

The purpose of this paper is to review what are considered to be the major factors that influence the accuracy of ship-cost estimates and to solicit comments from the cost-estimating community that will aid the authors in developing satisfactory techniques for forecasting economic and market conditions. (This paper is contained in the *Proceedings* of the Fifth Annual DoD Cost Research Symposium, held 24 and 25 March 1970.)

83. *Managerial Innovations in Ship Repair*, by Comdr. Ray P. Jones, USN (Washington: Industrial College of the Armed Forces, March 1970) (DLSIE-CB).

Considerable difficulty is being experienced in the U.S. shipbuilding industry, particularly in the field of ship repair; cost and time increases are common experience. This paper illuminates the narrow and stringent case of submarine repair in a government shipyard. The functional areas of management associated therewith are delineated. Innovations of management applied during a submarine overhaul are cited. Using the results of three sister-ship submarine overhauls, a comparative analysis is made. Additionally, the broadened utility of the innovations is shown in comparative analysis of the repair of two aircraft carriers. (This thesis is available on interlibrary loan from the ICAF library.)

84. "Methodological Problems in Estimating Costs of Shipbuilding Programs and Some Proposed Solutions," by Henry Solomon (Washington: Office of the Assistant Secretary of Defense [Systems Analysis], March 1970), 16 pp. (DLSIE-CB).

The major orientation of this paper is the task of estimating costs of new-construction Naval vessels at the preliminary-design stage of development. There are a host of factors to be considered in this estimation process. The objective of this paper is to discuss these factors and to indicate some preliminary results from dealing with only a limited number of them. (This paper is contained in the *Proceedings* of the Fifth Annual DoD Cost Research Symposium, held 24 and 25 March 1970.)

85. "Planned Availability Approach to Improving Ship Overhaul Effectiveness, The," by Raymond Ramsay (Washington: Naval Ship Systems Command, 1970), 26 pp. (DLSIE-CB).

This paper presents a scenario of the growing Soviet naval strength and a brief review of the trends in construction costs that have accompanied increases in ship-design complexity, from World War II to the present. Pre-overhaul planning considerations are discussed, and emphasis is placed on the need to improve overhaul effectiveness in the interest of maximizing fleet combat readiness. Finally, the principal advantages and limitations of implementing a planned-availability concept are presented, together with a reference to the interfacing maintenance and material management (3M) system. (This paper was presented at the 7th Annual Technical Symposium of the Association of Senior Engineers, Naval Ship Systems Command, 1970.)

86. *Review of Naval Shipyard Capability and Capacity*, Enclosure 1, Bureau of Ships Staff Study: *Worldwide Review of Naval Shore Establishment* (Feb. 1970), approx. 70 pp., CONFIDENTIAL (IDA).

This document appeared in the much larger *Worldwide Review*, prepared as a Naval staff study in response to a December 1969 CNO directive. The review is structured as a condensed update

of two similar shipyard studies done in 1964 and 1967 (considered by the authors to be still relevant), spells out much of the strategic and operational requirements for shipyard capacity, projects the workload and drydock requirements, and supplies data on minimum shipyard size and the need for shipbuilding assignments to Naval shipyards--sufficient to provide a reservoir of surge capacity to meet emergencies. Though the authors based their projections of workload and drydock needs on the June 1969 Five Year Defense Plan, they also examined variations from that projected level.

The report supplies conclusions and recommendations in four general areas of concern: (1) strategic and operational requirements for shipyard capacity, (2) workload versus capability, (3) drydock requirements versus capacity, and (4) shipyard closure. The review concludes that decisions made by the Secretary of Defense on the basis of the 1964 Study of Naval Requirements for Shipyard Capacity were still valid. It also suggests actions to be taken to provide surge capacity for emergency work at certain yards.

87. *Simulation Study of SONAR (SQS-23 TRAM) Overhauls on Naval Ships, A*, by Lt. Comdr. William Lawrence Fulton, USN (Monterey CA: Naval Postgraduate School, April 1970), 137 pp.. (DLSIE-CB).

A demonstration of using the technique of computer simulation for analyzing scheduling problems in Naval shipyards is provided. A model is formulated for multiple ship, concurrent SONAR (SQS-23 TRAM) overhauls at the Long Beach Naval Shipyard. This model (an extension of PERT) considers the effects of probabilistic activity times and of limited personnel resources. The "Transim" simulator is utilized to assist in predicting the ship-overhaul times and manpower utilization under different conditions. Two experiments consider changes in relative overhaul-commencement dates and modifications to the personnel-resource

levels. Complete descriptions both of the conceptual and computer models and of the input coding are included in the report.

88. *Statistical Analysis of the Engineering Approach to Navy Shipbuilding Cost Estimation, A*, by K. C. Yu, sponsored by Office of Naval Research (Washington: The George Washington Univ., Institute for Management Science and Engineering, June 1970), 67 pp. (DLSIE-CB).

The feasibility of developing regression models to predict the total cost of a Navy ship (using the physical weights of the ship components as independent variables) was investigated. The various forms of regression analyses fall under three categories: (1) linear multiple regression analysis; (2) nonlinear multiple regression analysis; and (3) adding-up process, which is an aggregation of two-variable regression analysis. It was found that the linear model is preferable to both the nonlinear model and the adding-up process. If the samples are properly selected, statistically significant linear models can be derived. Given its superiority over the other two models, the degree of accuracy of the linear model is still not high enough to produce a dependable point-estimation for the total cost of the ship.

89. *Status of Shipyards, U.S., Congress, House, Hearings before the Seapower Subcommittee of the Committee on Armed Services - June, July, August, November, and December 1970*, 91st Cong., 2d sess., 2 vols., approx. 2,000 pp. (IDA).

These hearings focus on testimony supplied primarily by officials of the Naval Ship Systems Command (NAVSHIPS) (i.e., Rear Adm. Sonenshein, Commander NAVSHIPS; and Capt. Ginn), the Maritime Administration (Mr. Gibson), the Shipbuilders Council of America (Mr. Hood), Gibbs and Cox (naval architects), the Assistant Secretary of the Navy (I&L) (Mr. Sanders), and the Assistant Secretary of Defense (I&L) (Mr. Shillito).

Volume 1, containing the testimony of spokesmen for NAVSHIPS, includes a comparison of the U.S. shipbuilding industry with that of other countries, the workload in U.S. shipyards, the

available capability and the general work requirements assigned to Naval yards, planned facility changes, funding requirements, composition of both the work and the work force in the various yards, workload trends, geographic distribution of Naval shipbuilding, and repair facilities necessitated by Navy requirements. NAVSHIPS officials also discuss their shipyard-modernization study and the deficiencies it uncovered and give extensive coverage to their SCN Pricing and Control Study, completed in April 1969. (SCN applies to a funding appropriation titled "Shipbuilding and Conversion, Navy.") That study was conducted to determine the cause of cost growth in Naval shipbuilding programs--and what could be done to arrest it.

NAVSHIPS officials also supply extensive descriptions (including pictures) of each Naval yard, its facilities, activities, and capabilities. The descriptions include types of facilities in place and available; various arrays of the composition of the work force; the programs in effect for developing worker skills and for improving working conditions; various summaries of wages and employee benefits, utilization of the work force, etc.

In Volume 2, Mr. Gibson outlines the Maritime Administration's program as it affects shipyards, including their problems with shipyards (i.e., late ship deliveries, handling of claims, management problems, labor shortages in selected skills and crafts). Mr. Hood shows that the private sector of the U.S. shipyard industry has the manpower, facilities, capacity, and capabilities to do much more shipbuilding and ship repair than is reflected in the present orderbooks and that the industry is prepared to expand to meet the challenge of new merchant and Naval shipbuilding programs. He introduces into the record a report of the economic significance of the Jones Act's impact on noncontiguous trade cargoes to such destinations as Puerto Rico and Alaska.

Spokesmen for several of the major yards address their present capabilities and commitments to the future. Each outlines the condition and capabilities of his own yard; his present orderbook; utilization of existing capacity; his management philosophy; his future plans concerning capital improvements, new tooling, expansion of capacity, and manpower availability. Several spokesmen complain about present Naval ship-procurement practices (citing, e.g., defective specifications, ambiguities and conflicts in the specifications, slow and complex processing of changes, effects of late or faulty government-furnished equipment). DoD and Navy representatives reply to the issues and criticism aired by the representatives of the shipbuilding industry and outline their changed procedures (present and contemplated) in dealing with the shipping industry.

Volume 3 supplies a ship-by-ship listing that shows for the ships in the merchant fleets of the major maritime nations tonnage, owner, crew size, speed, etc.

90. "Testimony of Vice Admiral Hyman G. Rickover," U.S., Congress, House, *Department of Defense Appropriations for 1971, Hearings before the Subcommittee of the Committee on Appropriations*, 91st Cong., 2d sess., pt. 7 (May 1970), approx. 100 pp. (IDA).

In recent years the committee has annually solicited Admiral Rickover's views regarding the military situation. This year his testimony touches on the status of the U.S. nuclear submarine, aircraft carriers, and frigate programs; and he expresses his thoughts on what can be done in these areas. Of more interest here, however, are opinions he expresses regarding DoD's contracting practices, mainly as they relate to inefficiency in the conduct of DoD business. The admiral voices his displeasures with various aspects of the procurement and contracting processes as conducted by the Navy, assailing various types of management and administrative looseness and inefficiency he has observed. He calls attention to the higher costs associated with work done

in certain yards--singling out the Portsmouth yard as "the most inefficient nuclear submarine yard, private or public, I have ever seen." The committee introduces into the record about 40 pages of the Admiral's correspondence to his superiors concerning procurement and cost control at private shipyards. The reproduced correspondence cites specific instances of alleged deficiencies.

91. *Thesis Concerning the Existence of Excess Capacity at Naval Shipyards Prior to the Escalation of Hostilities in Southeast Asia in 1964*, A, by Marshall Rose, Professional Paper no. 9 (Arlington VA: Center for Naval Analyses, 9 Jan. 1970), approx. 100 pp. (IDA).

With the objective of determining whether excess capacity existed in Navy shipyards prior to the escalation of hostilities in Southeast Asia in 1964, this paper examines ship overhaul policies in statistical terms. The author supplies a critical review of previous research (statistical analysis) done on the overall problem of ship-maintenance policy. On the basis of examination of operations at the Long Beach shipyard in FYs 1961 and 1963, he makes several observations:

- No statistically significant changes in overhaul-cycle lengths for destroyer ships.
- Productivity of labor there varies for such inappropriate reasons as changes in funding policy.
- The length of time between prior overhauls for destroyer ships repaired in this yard during 1961 cannot be shown to have affected the man-days needed per rework.

The author shows that, as funds become restricted in Naval yards, both man-days and resources cost per ship decline; but the resource cost declines by a greater percent than the man-days. Rose concludes that Navy yards did have "excess capacity" prior to 1964; that is, if more funds had been available for overhauls, the yards could have used the money to intensify repair work per ship without extending ship down-time.

92. *Weakness in Award and Pricing of Ship Overhaul Contracts*, Report B-133170, by the Comptroller General of the United States to the Congress (March 1970), 42 pp. (IDA).

A 1959 report by the General Accounting Office (GAO) had disclosed absence of effective price-evaluation procedures in the Navy; further, this absence resulted in the award of the overhaul work at unnecessarily high prices. More recent Navy internal audits show that similar conditions still existed in 1972. The GAO found, for example, that almost 90 percent of the value of initial-award packages for ship overhauls is awarded under advertised contracts but that constrained competitive circumstances surrounding these awards are not conducive to keen price competition. The constraints include the Navy's policy of having ships overhauled at or near homeports, which reduces the number of firms available to bid on the work. Further, only a limited number of shipyards can do certain types of overhauls; and specialization exists by contractors within the ship-repair market. GAO contends that, in such a limited competitive atmosphere, advertised procurement methods should be used only where there are other assurances that prices are fair and reasonable. Though the Navy prepares its own estimates of the cost of proposed overhaul work, it apparently places little reliance on its estimates when negotiating contractors' bids. The Navy's cost estimates are, of necessity, based primarily on judgment, because they lack adequate historical cost and procurement records in the detail necessary to be useful in evaluating bids. Moreover, in the course of the overhaul, substantial amounts of work are as a rule added to the initial contract award; and the additional work is generally negotiated on a sole-resource basis, because the ship's immobilization at the contractor's yard makes it impractical to solicit competition.

To correct the situation, GAO suggests that the Navy not only should require contractors to prepare and submit itemized bids but also should reject bids that substantially exceed the Navy's own cost estimates.

93. *Work Management System to be Used by Ship's Force During Overhauls and Availability, A*, by Lt. Comdr. David B. Boney, USN, et al. (San Diego CA: Navy Manpower and Material Analysis Center, Pacific, Dec. 1970), 83 pp. (DLSIE-CB).

This study represents a general examination of the existing ship's force overhaul-management systems and the procedures prescribed for ship's force personnel in using those systems. The study reveals that no single system offers the total necessary requirements and procedures that should be contained in the optimum system. The study concludes that a single ship's force overhaul-management system should be adopted to assist in providing standardization for ship overhauls throughout the fleet. The study contains a control-system guide that provides the criteria for such a ship's force system.

1969

94. *Analysis of the Competitive Position of the United States Shipbuilding Industry*, by Comdr. William W. Bowers, USN (Washington: Industrial College of the Armed Forces, March 1969), 92 pp. (DLSIE-CB).

American-built ships have not been price competitive since the days of wooden ships. Is it possible to restore the competitive position of U.S. ships? If so, what will it take? High labor costs, failure of government shipbuilding subsidies to promote efficiency, lack of cooperation between the various factions of the industry, and the adverse effects of huge wartime building programs have been the major reasons for high U.S. building costs. Recently, however, the prospect of reducing the competitive gap has improved--due largely to industry-wide U.S. plant modernization and a rise in foreign building costs--until today it is the best it has been in a century. What is needed now is a long-range building program that will receive the support of all elements concerned within government, labor, and industry. Such a program (containing eight major points) is recommended in this paper. (This thesis is available on interlibrary loan from the ICAF library.)

95. *Determination of Weight, Volume and Construction Costs for Naval Combatant and Auxiliary Ships*, by R. P. Johnson et al., sponsored by Office of the Director, Operational Requirements and Development Plans, DCS (R&D), HQ USAF (Santa Monica CA: The Rand Corporation, April 1969), 328 pp., CONFIDENTIAL (DLSIE-CB).

This memorandum presents a simple method of obtaining design characteristics, weights, volumes, and costs of various sizes and types of ships on the basis of their fundamental operating requirements. The design characteristics are determined first; and, on the basis of these characteristics, first-order estimates of weight, volume, and cost are obtained. Details of component weights, volumes, and costs of a number of ships (estimated in accordance with usual shipbuilding practice) have been analyzed, with the data plotted in parametric form. Working

charts showing the relationships of component weights, volumes, material cost, and man-hours for the respective Navy weight and cost groups are presented in the body of the report, where the accuracy of the estimating techniques is demonstrated. Generally speaking, the weight, volume, and cost of more than 80 percent of the ships analyzed could, by the methods presented here, be estimated with errors of 10 percent or less.

96. *Economic Analysis of the US Shipbuilding Industry--1968-1980, An*, by W. F. Beazer et al., IDA Report R-159, for the Assistant Secretary of Defense (Systems Analysis) (Arlington VA: Institute for Defense Analyses, July 1969), 93 pp. in vol. 1 [vol. 2, containing only supporting appendixes, not reviewed] (IDA).

This report examines the effects of alternative shipbuilding programs and government procurement policies on the size and location of the U.S. private shipbuilding industry and on the cost of ships. These effects are estimated from a linear programming model that simulates the activities of 15 private shipyards.

The model is used to test the implications of two alternative volumes of shipbuilding, encompassing Naval and commercial ships. The smaller program (36 ships per year) is based on a projection of action and plans available in the years just prior to the study, while the larger program (about 70 per year) includes much higher rates for both commercial and Naval construction. Different delivery schedules are tested for each program. The model can test any set of ship demands.

In essence, the model minimizes construction costs of ships to be built in 15 shipyards between 1969 and 1980. It aggregates ship orders into 10 categories that are composites of a specific design. It then allocates these orders to the yards with the lowest costs until the costs of adding employment to these facilities (to achieve expanding production) raises costs there above costs in competing yards (or until capacity is reached).

97. "Impact of Contract Definition on the Shipbuilding Program, The," by Johns Haines (Brooklyn NY: Naval Applied Science Laboratory, May 1969), 10 pp. (DLSIE-CB).

This paper covers the following topics as it discusses the impact of contract definition on the shipbuilding program:

- Background of the concept-formulation/contract-definition process for ship acquisition.
- Navy/shipbuilding industry relationships.
- Current applications.
- The conventional ship-acquisition process.
- Contract definition.
- Modified contract definition.
- Merits of contract definition.
- Ships performance effectiveness.
- Demerits of contract definition.

(This paper is contained in the *Proceedings* of the NMC Fifth System Performance Effectiveness Conference, 21-22 May 1969.)

98. *Improving the Prospects for United States Shipbuilding, Final Report--January 1969* (Glen Cove NY: Center for Maritime Studies, Webb Institute of Naval Architecture, Jan. 1969) (IDA).

This study explores the possibilities of reducing U.S. commercial shipbuilding costs to make the industry more competitive with foreign yards. Particular attention is given to reducing the expected ship-construction costs when ships are built under stable multiple-production conditions.

The report concludes that there is no simple solution for improving U.S. shipbuilding costs. It suggests that, to revitalize both the shipbuilding industry and the environment in which it operates, over a period of years aggressive steps are needed: stabilizing production, building ships in quantity, making capital improvements designed to reduce costs, improving design (simplification of structure, outfitting, modular construction, standardization of components), upgrading shipyard

management techniques, and pursuing R&D programs aimed at better ship design and building techniques (specific samples are supplied in appendixes) for easier and more economical production. The authors conclude that, though shipbuilding in the United States (even under favorable conditions) cannot become fully competitive with foreign industry for various reasons (e.g., government attitudes, the multipurpose structure of the yards, the higher living standards of the United States, the unstable climate in the United States for long-term shipyard investment), the differential can be greatly reduced.

99. *Late Delivery of Components in New Construction and Conversion, Navy Ship Programs*, sponsored by Office of the Assistant Secretary of Defense (Installations and Logistics) (Washington: Logistics Management Institute, July 1969), 101 pp. (DLSIE-CB).

The primary purpose of this task was to determine the impact of late delivery of components upon the contracted completion date and the final price of new construction and conversion ships. Components are defined to include (1) government-furnished property incorporated into or installed within a ship during construction/conversion and (2) contractor-furnished material. A secondary purpose of the task was to determine the impact of increasing component lead-time upon basic ship-acquisition program planning. This report documents efforts to develop a statistical relationship between late delivery of ship components and equipments to shipbuilders and the rate of shipbuilding progress.

100. *Measuring Productivity in the U.S. Shipbuilding Industry*, by Mordechai Lando, sponsored by Office of Naval Research (Arlington VA: Center for Naval Analyses, Sept. 1969), 37 pp. (DLSIE-CB).

This document reports on changes in productivity and real labor costs in the shipbuilding industry and presents several alternate measures that indicate during the years 1958-66 a rise

in productivity, which (it is argued) was due to increased demand--particularly military demand--rather than the introduction of new technology. Also discussed are the available price indexes for the shipbuilding industry.

101. *Merchant Marine Policy*, by Clinton Whitehurst, Jr. (Washington: American Enterprise Institute for Public Policy Research, 1969), 114 pp. (IDA).

Whitehurst sets the stage for this report by pointing out that, as of 1969, American-flag foreign-trade ocean shipping is in trouble, but that (he is confident) Congress will attempt to insure its survival. He acknowledges that, though the shipping industry has relatively low economic impact on the United States, it commands strong Congressional and Presidential support. In this framework, the author traces the development of American shipping from its beginning to the present. Giving special attention to the Merchant Marine Act of 1936, he shows how well it has served both the national interest and a number of individual maritime interests (e.g., the Navy, seafaring labor, ship-owners, shipbuilders, commerce, and the public). He supplies a chronological review of the government agencies responsible for Merchant Marine regulation and well-being and devotes a chapter to explaining how the present state of maritime affairs came about. He examines and analyzes major proposals for remedying maritime ills (i.e., Federal Government proposals, labor-union proposals, management proposals, and bills proposed in the Congress) and offers his assessment of the future of the U.S. Merchant Marine. He devotes a chapter to the urgent need to reduce operating costs of American vessels by reducing the wage bill. Finally, he presents some comparisons of U.S. and Soviet merchant fleets--past, present, and future. (N.B. The author is Chairman of the Faculty of Engineering Management, Clemson University. The Institute sponsoring this research paper is a nonpartisan research and educational organization that studies national policy problems. The analysis predates

President Nixon's message to Congress outlining a substantially revised maritime program.)

102. *National Security Study Memorandum #54, ROUNSCAR*, by (mainly) the Department of the Navy (Sept. 1969), SECRET NOFORN (IDA).

Because a portion of this memorandum supplies an analysis and characterization of the U.S. shipbuilding industry, it is of interest here. The report contains numerous summaries and charts that address various aspects of U.S. shipyards at the national level. Typical of the topics addressed are total tonnage output of U.S. yards, availability of shipyard facilities (aggregated in selected broad categories), composition of shipbuilding labor, manning problems, and nationwide production capability of U.S. shipyards in selected major areas of ship components (propulsion, ordnance, electronics). The memorandum laments U.S. ship-acquisition practices, especially the instability of ship-construction funding and programs in the industry and the long delivery times required for obtaining Naval ships. The memorandum touches on attempts made to standardize ship design and to obtain series-production in ship construction; specifies features of U.S. warships that drive up their unit cost; delineates some key national shipbuilding policies, including subsidies affecting shipbuilding; and reports findings about the shipbuilding industry overall and then focuses these findings on Naval shipbuilding and merchant shipbuilding.

103. *Status of Naval Ships*, Report by the Seapower Subcommittee of the Armed Services Committee, U.S., Congress, House, 91st Cong., 1st sess. (19 March 1969), pp. 415-82 (published as vol. 5) (IDA).

This portion of the committee's report on the status of Naval ships reflects their findings after intensive staff review of ship-construction programs, including seven hearings and visits by the staff to 13 major shipyards and ship-repair

facilities. The report shows the number of ships in the U.S. and Russian navies by age group for each type of ship (e.g., cruisers, diesel, submarines, frigates). It also shows that at the time of the report the average age of the ships in the U.S. Navy was 17.5 years and that 58 percent of the U.S. naval combatant ships were 20 years old or older, whereas less than one percent of the Soviet Navy ships were that old.

The report reviews funding (in terms of New Obligational Authority) for the years 1962-69. It presents the Navy's force-level and ship-construction program for each of those years by type of ship. Finally, the report forecasts the Navy's fleet requirements for 1980 (e.g., a total of about 850 ships of modern design) and lists some of the considerations entering into establishment of that total quantity. The report offers numerous photographs to illustrate the old age and deterioration afflicting many of the ships and the crowded working conditions endured by crew members on some of them.

1968

104. *Automated PERT/CPM Production Scheduling Application on the UNIVAC III, An*, by Abel W. Camara (Bethesda MD: Naval Ship Research and Development Center, Dec. 1968), 492 pp. (DLSIE-CB).

This report represents a complete documentation of the automated PERT/CPM (Program Evaluation Review Technique/Critical Path Method) production scheduling application on the UNIVAC III. This application has been designed to be a completely automated time-scheduling system for use in a large-scale production environment such as the Naval Shipyards. This scheduling system has been designed to function as an integrated part of the Shipyards' Management Information System. This manual has two major parts: the first presents detailed information on the techniques and methods utilized within the application; the second, detailed information on the computer aspects of the system, including the individual programs. In addition, the manual contains a complete set of formulas that have been either utilized by the system or developed for it.

105. *Engineered Long Range Modernization Program for the U.S. Naval Shipyards*, by Kaiser Engineers, Oakland CA, sponsored by the Department of the Navy (Washington: Naval Ship Systems Command, March 1968), numerous vols., FOR OFFICIAL USE ONLY (IDA).

Because obsolescence of the entire Naval Shipyard complex loomed as a threat to the fulfillment of its fleet logistic-support mission, the Navy asked Kaiser Engineers in 1966 to analyze its shipyard facilities in depth and to develop a complete modernization program. Beginning with the Long Beach and Philadelphia yards, the study eventually included 11 Navy yards (Portsmouth was excluded).

The study's aim was to define the facilities and equipment needed to accomplish NAVSHIPS' directed mission, task, functions, and workload projected for FYs 1968-75 for each shipyard. The team first devised a methodology and procedure for defining the facilities and equipment requirements for a shipyard when its

mission and workload are known; it then itemized the changes, additions, and modernizations necessary to accomplish that mission and workload most expeditiously. In brief, Kaiser developed a total program for use by the Navy in its program and budget review.

In accomplishing its task, the team developed standardized units for expressing projected workload of the various ship-yards in terms of facility and equipment requirements. For example, they developed the concepts of (and defined) a Functional Work Group (FWG), a Notional Ship Unit, and a Minimum Capacity Unit. On the basis of such standardized units, they were able to translate the forecast requirements for a yard into a meaningfully programmed workload.

(N.B. This 1968 modernization-program study has been updated by a 1974 publication under the same title, but published by NAVSEA--see Item 9, above. The newer study is based on a later set of requirements and incorporates changes in the size and composition of the fleet, plus changes in the available shore facilities.)

106. *Long-Range Maritime Program* (Washington: GPO, 1968), 76 pp. (DLSIE-CB).

This document is an addendum to the Congressional hearings (April-May 1968) on bills to amend the Merchant Marine Act of 1936 and other statutes, in order to provide a new maritime program. It contains a study entitled "Economic Impact of Tax Deferred Capital Funds for Unsubsidized Vessel Operations" (June 1967) by Ernst and Ernst, Washington DC. The Ernst and Ernst study examines the maritime vessel-replacement needs of the unsubsidized operators and the impact of meeting those needs through the provision of tax-deferred capital-reserve funds.

107. "Objective Look at Shipbuilding in the United States, An," by Edwin M. Hood and Nathan Sonenshein, paper presented at SNAME Diamond Jubilee Meeting, 18-21 June 1968 (WEBB).

This paper endeavors to place in focus the state of shipbuilding both in the United States and elsewhere. The authors give a profile of the industry, an assessment of marketing opportunities, a description of Navy procurement practices, and an evaluation of the industry capability in Japan, Sweden, and the United States.

108. *Reconnaissance of the Navy Ship Overhaul Program* (Washington: Logistics Management Institute, Dec. 1968), 32 pp. + appendixes (IDA).

This report summarizes results of LMI's preliminary survey of the Navy's Ship Overhaul Program. The survey was made to gain enough familiarity with the program to permit a more detailed search for new approaches, methods, and techniques for use by the Navy in the overhaul of its ships. The report notes that the Navy was conducting a somewhat parallel in-house study--"Ship Overhaul Improvement Program" (SOIP)--aimed at identifying depot-maintenance problems and providing a systematic approach to their correction. LMI's task, however, has a broader scope and is aimed at assuring that major opportunities for gain (which might call for a major restructuring of the present ship-overhaul system) are not overlooked.

In carrying out its task, the LMI team attempted to define the issues that bear upon the selection of a maintenance strategy from among alternative strategies that might be applied within the active fleet. It soon found that overhauls cannot be considered in isolation--because of the great interdependency among the three levels of ship maintenance (i.e., organization, done on board; intermediate, done by tenders and repair ships; and depot, done by shipyards). The paper attempts to describe (and to set into an overall context) the whole overhead problem--including the impact of ship alteration, the material condition

of the ships, etc. The report categorizes and describes the alternative maintenance strategies available (for the use of maintenance resources in maintaining a given level of material ship condition). Finally, the report outlines the team's aim in the proposed follow-on study effort and includes a 10-page bibliography of documents consulted in this initial survey.

109. "Shipyard Management--The Operation of a Man-Machine System," a paper by D. M. Mack-Forlist, in *Proceedings of the SNAME Spring Meeting, 1968*, 14 pp. (ID4).

The author, former general manager of the Sparrows-Point Yard, focuses his remarks on U.S. seaboard shipyards; he describes how their technology, product, and environment have changed radically since World War II--noting that they operate in a limited, fluctuating, government-controlled market in the interface of two different economies. He presents a series of incisive characterizations of these shipyards--their organization, resources, and products. He describes how management guides the operation of these yards by creating a conceptual framework, directing the creation of a human framework, and supervising the creation of a capital framework. He notes that the concepts of the mass-production industries or the methods of foreign shipyards will not guarantee success in the economic environment of the U.S. yards. He stresses that innovation in production technology alone is not enough and demonstrates instead that shipbuilding everywhere is a labor-intensive, man-paced industry. Accordingly, he suggests that the stress should be on organizational innovation--first to achieve a new spirit of growth and reorganization to adapt to the changed environment. Conversely, innovation in technology of product and process requires investment and reorganization of the market--which in turn demands cooperation by government, unions, universities, and yards.

110. *Stochastic Constrained Optimal Replacement Model for a Set of Ships, A*, by Peter J. Kalman, sponsored by Office of Naval Research (Arlington VA: Center for Naval Analysis, Nov. 1968), 45 pp. (DLSIE-CB).

A stochastically constrained replacement model is formulated. It determines a sequence of replacement dates such that the total "current account" cost of all future costs and capital expenditures over an infinite time horizon for the N initial incumbent ships is minimized, subject to the constraints that a certain number of ships are in a chosen military-worth class at any point in time. The theoretical model was then solved for a specified set of assumptions.

111. *Study of Shipbuilding Capacity and Requirements*, by Ernst G. Frankel, sponsored by Office of Naval Research (Cambridge MA: MIT, July 1968), 130 pp. (DLSIE-CB).

This study discusses some of the requirements for increased ship-maintenance productivity. In order to accomplish improvements, an integrated effort must be made to utilize the multitude of modern-production, material-handling, control, management, and labor-effectiveness methods. Only if and when ship production is transformed into a well-balanced and planned production process will substantial improvement occur.

1967

112. *1968 Shipbuilding and Conversion Program* (Washington: Department of the Navy, Office of the Chief of Naval Operations, Oct. 1967), 46 pp. (DLSIE-CB).

The Navy's FY-68 shipbuilding and conversion program consists of 27 new construction ships, 21 conversions of existing ships, and 108 various service and landing craft. This pamphlet lists the ships (by classification and project number) and briefly describes the conversions and intended operational usage of the ships. Included is a photograph or drawing of each type of ship.

113. *Alternative Subsidy Methods for the United States Merchant Marine*, sponsored by Department of the Navy, Office of the Chief of Naval Operations (Washington: Ernst and Ernst, Dec. 1967), 164 pp. (DLSIE-CB).

This study examines alternative methods of providing construction and operating subsidies to the U.S. Merchant Marine in terms of cost to the Federal Government and in terms of the impact on the operator's costs. It also compares the costs of one alternative form of construction aid and of an alternative operating subsidy with present subsidy systems, in terms of specific types of vessels and in terms of projected vessel-construction programs.

114. "Application of NAVMATINST 4000.15 to Shipyard Work," by Philip G. Sellow (Washington: Naval Ship Systems Command, 1967), 7 pp. (DLSIE-CB).

Presented at the Naval Ship Systems Command Symposium on Technical Data Management (12-14 September 1967), this paper discusses the application of NAVMATINST 4000.15 (a policy manual entitled "Management of Technical Data and Information") to shipyard work.

115. "Case Studies in Computer Simulation, A Comparison: PERT Vs. TRANSIM Network Analysis," by John A. Momm, sponsored by Office of Naval Research (Los Angeles: Univ. of California, Department of Engineering, July 1967), 24 pp. (DLSIE-CB).

Estimates of time to complete a Naval ship boiler repair as part of a regular ship overhaul are developed by two different analytical methods, PERT and TRANSIM, in order to conduct a comparison between the two techniques of network analysis. The later is a Monte Carlo-type, general-purpose simulator, capable of including in the analysis the variance of activity times as represented by individual probability distributions-- which permits utilization of input activity distributions (based on actual histograms) and develops variations in the critical path (due to the stochasticity of activity times). A comparison of results obtained with the two techniques provides reliable measures of the errors due to PERT assumptions and approximations.

116. *Department of the Navy Management Accounting for Facilities Maintenance and Utilities Operations*, by Comdr. Edwin C. Paul, USN (Washington: Industrial College of the Armed Forces, March 1967), 58 pp. (DLSIE-CB).

There is a conflict between objectives of the DoD Resource Management Systems Improvements and present procedures for managing the Navy's Facilities Maintenance and Utilities Operations Function. The compromise solution, developed as a result of the project's prime field-test installation, does not resolve the conflict. Two opposite courses for future improvements appear possible, but complete association of facilities-maintenance and utilities-operations costs with the program elements they support has the potential for resolving the conflict and maximizing management gains. (This thesis is available on a loan basis from the ICAF library.)

117. *Incentives for Achieving Component Standardization in Ship Construction*, sponsored by Office of the Assistant Secretary of Defense (Installations and Logistics) (Washington: Logistics Management Institute, Dec. 1967), 45 pp. (DLSIE-CB).

A study is made of the Navy's standardization incentive clauses. The study had three principal objectives:

- To appraise the effectiveness of the present incentive clauses toward achievement of the present incentive of improved standardization of hull mechanical/electrical equipment.
- To develop, if feasible, uniform criteria for establishing the amount of monetary incentive required to motivate shipbuilders to standardize on ship components in the overall best interest of the government.
- To develop recommendations for useful modifications to the presently used incentive clauses, which will provide improved overall benefits.

The study recommends (1) that future ship-construction contracts include a comprehensive standardization clause (which contains both a mandatory requirement and optional incentive provisions for achieving component standardization, in accordance with the standardization plan proposed in the report) and (2) that the Navy initiate an indoctrination program for the purpose of explaining the new standardization clauses and soliciting management support from the shipbuilding industry.

118. "Multi-Year Ship Procurement and Other Ship Acquisition Concepts," by Graeme C. Bannerman, *Journal of ASNE* (Dec. 1967) (WEBB).

A discussion of new Navy ship-acquisition processes and techniques--including integration of ship designs with production capability (by contracting for final design and production from a single shipbuilder), series production of substantial numbers of ships covering several years' programs, and evaluation of competing design and shipbuilding proposals on the basis of their total lifetime costs.

119. *Report on Indirect Government Aids to U.S. and Foreign Maritime Industries*, for Shipbuilders Council of America (Washington: Ernst and Ernst, April 1967) (WEBB).

In six countries reported, all provided to their maritime industry aid that was directed primarily to vessel acquisition. Japan, Norway, Sweden, and the United Kingdom offer credit facilities at good rates for foreign buyers--the incentives being at least as good as those offered to the native buyers. Details and data are given.

120. *Sealog Ship Concept Study--Phase 2, V.5: Effect of Shipyard Automation on FDL Price*, by F. A. P. Frisch and V. L. Broussalian, sponsored by Department of the Navy, Office of the Chief of Naval Operations (Arlington VA: Center for Naval Analysis, May 1967), 42 pp. (DLSIE-CB).

This volume reports the result of an economic analysis of the effect of ship-program size on the incentive to build a new, mechanized shipyard with specified characteristics. The methodology employed is a novel adaptation of the generalized investment-decision model. In this adaptation, the period beyond the termination of the FDL Shipbuilding Program is subsumed in a term called "the anticipated remaining value of the shipyard investment"; and per ship (for varying program sizes from 9 to 57) are computed bid prices that will cover all production costs and yield an after-tax specified rate of return. Nine combinations of assumptions about production-cost estimates, payment provisions, delivery schedules, and after-tax rates of return were employed; and, for each set of assumptions, calculations of price program-size curves were made for three alternative new-shipyard remaining values.

121. "Ship Procurement--Isn't There a Better Way?" by Charles Zehen, SNAME Philadelphia Section, 21 October 1966 [also in *Marine Technology* (July 1967)] (WEBB).

The author argues for a return of "normal" economics in the shipbuilding industry. The shipbuilder should actively solicit

business directly from the shipowner, and shipyard participation to improve its product should be sought through performance-type contracts. The expected effect would be a much shorter procurement time for the owner and a reduction in dependence on direct Government subsidy.

122. *Study of Requirements for Naval Shipyard Capacity--1967*, by staff of Chief of Navy Material (Washington: Department of the Navy, Dec. 1967), approx. 100 pp., CONFIDENTIAL (IDA).

This report is the product of an ad hoc Naval study group established by the Chief of Naval Material to review the currency of a similar earlier staff study (*Study of Naval Requirements for Shipyard Capacity--1964*). The more intensive earlier report had recommended closure of a Naval yard, while this later report evaluates significant developments since that earlier closure decision.

In this 1967 study, all industrial facets of the nine U.S. Naval shipyards were reexamined and considered together with the total resources at 80 of the largest private yards. The report proceeds first to summarize the shipbuilding/ship-repair industry by focusing on capacity and utilization data for the Naval yards; it then analyzes the peacetime requirements for Naval shipyards--based on strategic factors, the operational support needs of the Fleet, industrial and drydock requirements, and manpower. Next, it calculates and evaluates the wartime-mobilization requirements for these Naval yards in a selected wartime scenario plus expected manpower- and industrial-utilization factors. Finally, the report presents the potential costs and savings associated with the proposed shipyard closure and offers its assessment of the capacity of each of these yards--including a suggested allocation of work assignments among the yards for each general type of work (e.g., alteration, repairs, conversion).

123. "Technical Data Management Problems and Procedures Concerning Engineering Support of Major Submarine Overhauls," by M. F. Page (Washington: Naval Ship Systems Command, 1967), 20 pp. (DLSIE-CB).

Presented at the Naval Ship Systems Command Symposium on Technical Data Management (12-14 September 1967), this paper describes the methods utilized to minimize turn-around time in submarine refurbishment.

124. *U.S. Merchant Marine and Its Relationship to U.S. Foreign Trade*, by Capt. Paul C. Boyd, USN (Washington: Industrial College of the Armed Forces, April 1967), 164 pp. (DLSIE-CB).

The Merchant Marine Act of 1936 has fallen far short of its goal in promoting a strong viable merchant marine adequate to carry a substantial portion of our foreign trade and to meet national defense needs. In some respects, the present liner fleet is the most modern in the world; other segments of the merchant marine, however, are faced with depressing prospects. The United States has permitted its merchant marine to decline, not so much by design as through inability to find a way to support an expanding merchant marine. A portion of the study is devoted to foreign trade to emphasize its interrelation with Maritime Affairs. Five problem areas (a declining merchant fleet, high cost of ship construction and shipping, deplorable labor-management relations, excessive governmental interference, and reliance on foreign shipping) are identified as significantly affecting the ability of the U.S. shipping industry to compete in world trade markets. (This thesis is available on a loan basis from the ICAF library.)

1966

125. *1967 Shipbuilding and Conversion Program* (Washington: Department of the Navy, Office of the Chief of Naval Operations, June 1966), 58 pp. (DLSIE-CB).

The Navy's FY-67 shipbuilding and conversion program consists of 46 new construction ships, 13 conversions of existing ships, and 123 various service and landing craft. This pamphlet lists the ships by classification and project number and briefly describes the conversions and intended operational usage of the ships. Included is a photograph or drawing of each type of ship.

126. *Economic Analysis of U.S. Shipbuilding Costs, An*, by Harry Williams, John D. Wells, Elizabeth R. Johnson, and Edward G. Sanders, IDA Report R-120 (Arlington VA: Institute for Defense Analyses, Economic and Political Studies Division, Dec. 1966), 158 pp. (IDA).

This report examines the investment cost of Naval ships, with the objective of determining whether alternative procurement practices might lead to reduced cost. The analysis is limited to privately owned shipyards in the United States and selected other countries (e.g., Sweden, Japan); it focuses on work actually carried out in the shipyard--ignoring, for example, costs of Government-furnished equipment. Three ways are identified in which procurement cost of Naval ships could be reduced:

- (1) The Navy could have aggregated its ship purchasing (between 1951 and 1965) so as to realize fully those cost reductions typically associated with volume procurement.
- (2) The Naval shipbuilding industry could have exhibited more efficiency than it did--given U.S. factory costs.
- (3) The Navy could purchase ships from selected foreign shipbuilders at reduced cost.

The report discusses indicators of efficiency applicable to U.S. and foreign shipbuilding (e.g., capital-labor ratios; ratios of productive to total labor; labor's portion of the

total cost in U.S. shipbuilding versus cost in selected U.S. industries and in foreign yards; differences in labor productivity among selected shipbuilding countries). U.S./foreign shipbuilding is viewed from the standpoint of differences in technical approach, production methods, and management features of the U.S. market (i.e., mainly its unpredictability, uncertainty, and short time-horizon). The authors illustrate how fragmenting the demand for ship construction increases costs, and they cite historical examples of cost reduction achieved when volume and standardization were present. Finally, some potential cost reductions (other than for volume and rate of production) are shown to result when a single-procurement buyer presents alternative large "planned" volumes (i.e., "shadow demands") to a shipbuilder.

127. *Final Report on Industrial Conversion Potential in the Shipbuilding Industry*, by William R. Park and Robert E. Roberts (Kansas City MO: Midwest Research Institute, March 1966), 221 pp. (DLSIE-CB).

The report contains--

- A summary and discussion of shipbuilding resources and capabilities, including general observations on the transferability of these resources to other industries' activities.
- A review of actual diversification attempts in the industry.
- A description of the analytical techniques used in screening the large number of industries with capabilities similar to shipbuilding's.
- An evaluation of the impact of disarmament on these industries, including considerations of compensatory spending,
- A brief summary on each group of products that appeared to offer potentially attractive opportunities for shipyards.
- Recommendations and guidelines for action by industry and government.

128. *Government Intervention in the Management of the United States Merchant Marine*, by Capt. Benjamin R. Eggeman, Jr., USN (Washington: Industrial College of the Armed Forces, Feb. 1966), 102 pp. (DLSIE-CB).

The purpose of this thesis is to examine the evolution of governmental assistance to the foreign-trade segment of the U.S.-registry Merchant Marine--particularly as to the construction and operating-differential subsidies and their returns, which the United States has received in the form of national benefits and external economies. Trends for the future in governmental intervention are examined in light of the DoD programs and Administration interests, as evidenced by the recent Boyd Report. Conclusions are reached that U.S. national interests are best served by continuation and expansion of direct governmental assistance to the Merchant Marine, in order to use the seas to maximum advantage in the international commercial competition of nations. (Student research project report available on a loan basis from the ICAF library.)

129. *Improvements in Complex Submarine Overhauls*, by Capt. W. A. Budding, Jr., et al. (Washington: Department of the Navy, Feb. 1966), approx. 150 pp., CONFIDENTIAL (IDA).

This document, known informally as "the Budding Report," is now quite old. At the time of its publication, it offered a penetrating, incisive, and hard-hitting report that examined (and offered suggestions for) a wide range of specific problem areas. The study was aimed at developing suggestions for controlling and minimizing the length of complex submarine overhauls. Though this study focuses on submarine overhauls, much of the narrative probably also has application to Naval shipyards in general. The team gives critical analysis to the various facets of processing a submarine through overhaul. The narrative, for example, examines such areas as--

- Deficiencies in the management, direction, and planning for the overhaul--assuming the availability of adequately trained personnel in the quantities needed.
- Improving the steps in the authorization and contracting for the overhauls.
- Positive steps in reducing the time required for the overhaul.
- Obtaining sufficient design lead-time to support the overhaul.
- Improving the mechanics of financial management and planning for the overhaul.

The report lists 26 conclusions, of which the following are (some of the shorter, but) representative:

- The resource trade-off criterion for an SSN is about \$100,000 a patrol day.
- The maximum efficient use of off-shifts and overtime is required to minimize the length of complex submarine overhauls.
- There is no Navy-wide concept or disciplined program for ship, ship-system, or ship-component standardization.
- In addition to a monopoly on the power to establish policy, virtually all substantive decision-making authority in technical, managerial, and contractual matters is centralized in the Navy Department.

Finally, the report provides a set of recommendations aimed at overcoming deficiencies uncovered.

130. (NAVSHIPS) *Shipyard Workload Study*, by the Shipyard Workload Study Group (Washington: Naval Ship Systems Command, Oct. 1966), approx. 200 pp. (incl. appendixes), CONFIDENTIAL (IDA).

This NAVSHIP staff report explored the feasibility of accomplishing the Navy's shipwork programs planned (in 1966) for the FYs 1967 and 1968 and future years. The narrative and analysis revolves around the following general areas:

- (1) The technical and physical capacity of the Naval and private shipbuilding complex to accomplish the work.

- (2) The ability to increase employment levels in both Naval and private shipyards commensurate with the increased workload projected.
- (3) The management system used to balance programs and resources.
- (4) The problems encountered in managing the shipyard workload in 1966 and assessing likely future prospects.

The study team concludes that difficulties experienced in meeting schedules in 1966 in both Naval and private yards were due mainly to manpower shortages, material shortages, growth in workload after the schedule had begun, and nonavailability of plans (i.e., follow-on shipyard drawings). Most of the manpower difficulties in Naval yards were traced to the Southeast Asian war and tardy reprogramming decisions (i.e., Naval yards were undermanned by about 7,000 man-years because of a ceiling based on planned workload). The team voiced concern over the high proportion of carrier work to private yards.

The study concentrated on analyzing the feasibility of accomplishing planned programs by evaluating the capacity and capability of the shipbuilding industrial complex (both Naval and private) to provide the physical, technical, managerial, and human resources required. In this connection, the team evaluated NAVSHIPS techniques for developing manpower requirements and the basic management system by which funds and manpower resources are coordinated in the DoD.

A portion of the report reconciles findings of an earlier report made in 1964 by the Shipyard Policy Board (*Study of Naval Requirements for Shipyard Capacity*, familiarly known in NAVSHIPS as "The SAG Report"). That study had concluded that the country's shipyard capacity was more than adequate to meet the country's foreseeable requirements under both peacetime and wartime conditions and, accordingly, the Navy had inactivated the New York shipyard (June 1966) and had announced plans to inactivate the Portsmouth yard by 1975. This later report

attacks some of the assumptions in that earlier report and points to the changed and unexpected conditions in the United States.

131. *Prediction of Probable Damage in Naval Shipyards Resulting from Thermal Radiation of Nuclear Weapons and Subsequent Fire*, by P. V. Phung and A. B. Willoughby (Burlingame CA: United Research Services, July 1966), 202 pp. (DLSIE-CB).

As part of the Target Vulnerability Studies (TVSSs), nine shipyards have been surveyed and studied for fire damage from thermal radiation of nuclear weapons and subsequent fire spread. Results are presented in the form of tables showing the extent of direct ignition to be expected for various detonation conditions and the chain of fire spread from each directly ignited structure. The methodology developed is intended for use in the USNRDL target-vulnerability-study evaluations of damage resulting to (and recovery effort required for) Naval shipyards and similar complexes from a nuclear attack.

132. *Prospects for Reducing U.S. Shipbuilding Costs, The* (Washington: Shipbuilders Council of America, March 1966) (WEBB)

A study is made of requirements for U.S.-built ships. Specific requirements that contribute to a higher U.S. cost over a comparable foreign-built ship are enumerated. Performance-type contracts, ordering ships in groups of five or more, a consolidation of regulatory body requirements and inspection, and other recommendations to reduce costs are made.

133. *Review of Price Increases Under Shipbuilding Contracts*, Department of the Navy (Washington: GAO, Dec. 1966), 53 pp. (DLSIE-CB).

The propriety of certain price increases under shipbuilding contracts was examined. This report illustrates the need for the government to establish that catalog prices represent those at which substantial sales have been made to the general public before relying on such prices as a basis for procurement actions. As a result of this review, the Navy is making

a detailed review to determine whether there was a breach of contract and/or a basis for recovery of the unwarranted price increase.

134. *Some Computer Applications for the Work Input and Control Phases of the Maintenance Cycle of Navy Public Works Centers*, by Lt. Comdr. Dean Gordon Wilson, USN (Monterey CA: Naval Postgraduate School, Aug. 1966), 94 pp. (DLSIE-CB).

Public Works Centers (PWCs) have recently emerged as a new type of organization for accomplishment of the Navy's maintenance function at large Naval bases. They are distinctly different from the older organizations for maintenance. Chapter I reviews this difference. The purpose of this study is to review the various phases of planning and control of the maintenance function in the new PWC environment--while considering older organizational methods. Chapter II describes current methods. Chapter III presents a proposed system for improving work input and control functions. The intent is to provide a reasonable and basic approach to these functions through the use of automatic data-processing equipment. The PWCs have great potential for use in new computer systems. This potential, which has been recognized by the Navy Facilities Engineering Command, is reviewed in the study. Though specific proposals are limited to work input and control, other potential applications are discussed in Chapter IV.

135. *Toward a More Competitive Merchant Marine*, by Capt. Robert H. Ewing, USN (Washington: Industrial College of the Armed Forces, March 1966), 88 pp. (DLSIE-CB).

The U.S. Merchant Marine has carried a steadily decreasing percentage of the nation's foreign trade since the end of World War II. High costs of ships and labor have made the Merchant Marine noncompetitive in world shipping markets. The considerable aid to shipping provided by the government has not prevented the declining participation in world trade by U.S.-flag ships. Four problem areas--costly ship construction, costly ship

operation, "flags of convenience," and labor-management relations-- have been identified as those that most significantly affect the ability of the U.S. shipping industry to compete in world trade. Recommendations include the development of definitive requirements for U.S.-flag shipping capability, improved productivity of merchant ships through automation, and amendment of the Merchant Marine Act of 1936 to permit greater flexibility in procurement and operation of ships of the Merchant Marine. (Student research project report available on a loan basis from the ICAF library.)

1965

136. *Conceptual Design of a Mechanical Shipyard for Fast Deployment Logistics (X) Production*, by Benjamin V. Andrews and Dan G. Haney (Menlo Park CA: Stanford Research Institute, Dec. 1965), 80 pp. (DLSIE-CB).

This report describes the results of a study of the conceptual design of a mechanized shipyard for production of the Fast Deployment Logistics Ship (FDLS). The objectives of the study were (1) to outline a concept applying modern manufacturing techniques to the development of a mechanized yard for the construction of FDLSs and (2) to provide a preliminary assessment of the yard capital cost and its production rate.

137. *Integrated Naval Shipyard Material Control System*, by Lt. D. R. Jahn, SC, USN, and Lt. Comdr. C. E. Sojka, SC, USN (Monterey CA: Naval Postgraduate School, 1965), 192 pp. (DLSIE-CB).

The Naval shipyards are in the process of implementing for themselves the Bureau of Ships Management Information System (MIS), which has as its keystone the production planning and control system and as its terminus the cost-accounting system. The purpose of the MIS is to improve management techniques, so as to reduce cost and meet the challenge of modern technology. A possible extension of the MIS is in the area of material redistribution between shipyards to forestall costly job delays and cancellations. This thesis explores the possibility of establishing a centrally managed redistribution system for material located in Naval shipyards that employ the techniques of rapid communications and automatic data-processing systems. The area of Direct Material Inventory (DMI)--the most unstructured and uncoordinated--is used to study the possibilities of establishing a feasible integrated Naval shipyard material-control system, to operate in conjunction with the present computerized logistics programs located at the Bureau of Ships.

138. *Maritime Policy and Program of the United States: Report and Recommendations of the Public Members of the Maritime Advisory Committee, Submitted to the Full Committee for Its Consideration* (Nov. 1965), approx. 100 pp. (incl. dissenting minority reports) (IDA).

This committee report has as its basic theme the renewal and expansion of the U.S. Merchant Marine. The first outlines the tenets under which the Maritime Advisory Committee (MAC) makes its proposal for achieving an expanded merchant fleet and then offers its specific proposals for achieving that objective. The committee's recommendations can be characterized by the headings under which they are introduced--namely,

- United States Subsidized Liner Cargo Service
- Unsubsidized Liner Cargo Service
- Dry Bulk Carriers
- Liquid Bulk Carriers
- United States Passenger Ships
- Ship Construction
- Labor Relations
- Flags of Convenience.

In the area of shipbuilding, the committee suggests continuance of subsidies (i.e., the construction-differential subsidy, the operating subsidy), to be granted only for U.S.-constructed vessels; it also recommends expansion of the U.S. merchant fleet (through construction in U.S. yards) and supports continuing the current procedures governing utilization of U.S. yards for ship repair. It specifies that construction-subsidy payment be made on the basis of direct support to the shipbuilding industry. The report includes rationale used by the committee in arriving at its recommendations. Published with the committee report are dissenting views of some of its members. These minority views suggest, for example, that the American shipowner should be allowed to acquire and repair his vessels at world-market prices and that the U.S. should agree realistically

to reduce crew complements (in line with automation) while still paying U.S. "going" wages.

139. *Need for Improvement in Pricing of Change Orders for Construction of Naval Vessels, Department of the Navy* (Washington: GAO, Sept. 1965), 46 pp. (DLSIE-CB).

Examination into the pricing of change orders issued under fixed-price contract for construction of FBM submarines disclosed that the prices were greater than appeared justified under the circumstances: accepted were prices that were not based on current cost data, that included costs for work that had not been authorized, and that provided insufficient credit for reduced or modified contract requirements. It was recommended that examinations be made into the prices negotiated for change orders issued under the other Navy contracts and that, where appropriate, adjustments in contract prices be obtained.

1964

140. "Economic Considerations in Establishing an Overhaul Cycle for Ships: An Empirical Analysis," by D. E. Farrar and R. E. Apple, sponsored by Department of the Navy, Office of the Chief of Naval Operations (Arlington VA: Center for Naval Analysis, April 1964), 20 pp. (IDA).

The authors are of the opinion that an extremely thin empirical foundation now underlies important decisions concerning the Navy's material maintenance, and that maintenance and repair expenditures for the Navy's already aging fleet can be expected to grow substantially in the future. Statistical operating and cost data for the Navy's Atlantic Fleet destroyer force are analyzed; the authors develop regression equations that relate ship's total maintenance cost, time lost from operations, reliability, and the length of the ship's overhaul cycle. Factors such as the ship's age, size, complexity, usage, etc., are held constant, as required. The overhaul cycle is viewed as the primary control variable by which Navy maintenance managers allocate effort between scheduled and unscheduled repairs; and the paper attempts to show the influence of the overhaul cycle on the dollar costs of the ship's maintenance and repair. The authors develop a minimum-cost overhaul cycle for two classes of ships; but, because there are no defensible cost penalties for time lost and reliability (i.e., reliability measured by the frequency of unscheduled repair), minimum cost and optimal cycles are not one and the same. Trade-offs between cost and reliability are presented, so that the range within which an optimal cycle can be expected to lie is narrowed considerably. The authors illustrate the importance of attempting to reduce time lost for shipyard repairs by noting that decreasing lost operational time for destroyers by one percent would add the equivalent of three destroyers to the Navy's active fleet.

141. *Report on Capacity and Utilization of Private Shipbuilding and Ship Repair Facilities--1963* (Washington: Shipbuilders Council of America, April 1964) (WEBB).

Data are given on the number of ship positions (piers, dry docks, and ways) by size category, shipyard facilities by total length and occupancy, private shipyard facilities utilization by type, number of vessels serviced in private shipyards in 1963, facilities and utilization by naval district, private shipyard productive manpower employment in 1963, and Naval shipyard facilities and employment. The occupancy of private shipyards averaged 42 percent.

142. *United States Shipyards and the Effects of Disarmament*, by D. M. Mack-Forlist, report submitted to Columbia Univ., 1964 (WEBB).

Recommendations are made to ensure continued operation of the shipbuilding industry in the event of disarmament. The author feels that the shipbuilding industry can survive on its own if attempts are made to reduce costs in design, management, and labor.

1963

143. "Cost Savings of Multiple Ship Production, The," by John C. Couch, SNAME Great Lakes and Great Rivers Section, 23 May 1963 [also in *International Shipbuilding Progress* (Aug. 1963)] (WEBB).

A presentation of learning-curve theory as applied to shipyard production (with various data), this work shows that reliable predictions of cost savings in multiple production can be made.

144. *Estimating Ships' Maintenance Funding Requirements*, by Center for Naval Analyses of the Franklin Institute, CNA Study no. 40 (June 1963), 75 pp. + appendixes (IDA).

For use by the Secretary of Defense, Secretary of the Navy, and CNO, the objective of this study was development of "a means for evaluating the validity for the increasing requirements of O&M funds when the total force level remains fairly constant but the composition is changing radically." More specifically, its objective was "development of techniques and indices for demonstrating the Navy's requirements for Ships' Maintenance Funds." The team developed two indexes to assist in programming and budgeting resources for ship's maintenance. The first it calls Index of Maintenance Effort Required (IMER), which accounts for changes in needed maintenance funds caused by changes in the numbers and types of ships in the approved Navy force levels; the second it calls the Index of Maintenance-Unit Cost (IMC), which measures the change in the annual maintenance cost per ship resulting from the aging of ships, their changed complexity due to alterations, the effect of improvements in maintenance technology, and the prices of materials and labor. Using 1963 as the base year, these two indexes are designed to be combined for use in predicting the budget funding program required in a year for which a force structure has been specified. The report shows how funding for the ships' maintenance program for 1967 may be estimated--given that the

planner is attempting to duplicate the quality of maintenance experienced in any of the base years (i.e., 1959-65). Though this report was published about 10 years ago, much of the methodology and analysis formulated therein is probably still useful today.

1962

145. *Report on Survey and Analysis of Differences Between U.S. Navy Shipbuilding Costs at Naval and Private Shipyards* (short title: *Shipbuilding Cost Study*) (Chicago: Arthur Anderson and Company, Nov. 1962), approx. 250 pp. + appendixes (IDA).

Though this report is now over 12 years old, it was at the time (in the words of a Bureau of Ships official) "the most complete and exhaustive study of comparative costs of Naval and private shipyards ever produced by an agency, government or private." The study was prepared for the Bureau of Ships and was limited to those ship construction, conversion, repair, and alteration programs under which reasonably comparable work was performed by both Naval and private yards and for which it was practicable to determine the costs and the types of work accomplished. The consultant gives considerable effort to adjust, purify, and refine the reported data to assure overall comparability. For example, costs reported by Naval yards are adjusted for depreciation, interest on invested capital, military pay, disability compensation, contract administration, etc.; conversely, costs reported by private yards are purged of state, local, and federal income taxes and are adjusted to give consistent treatment in categorizing direct/indirect personnel (e.g., shop foreman) time and costs. Separate sets of cost evaluations and conclusions are supplied for each type of activity (e.g., new construction, repairs, alterations, conversions). For example, on the selected sample of 24 ships, the construction costs for 14 ships built at five private shipyards showed a lower cost to the government than the comparable 10 ships built by six naval shipyards--by amounts ranging from 15 to 31 percent, depending on the type of ship. Higher overhead rates at the Naval yards are shown to account for most of this difference.

(N.B. The Bureau of Ships [BUSHIPS] prepared its own evaluation of this report in a 22-page document, "Bureau of Ships Analysis of Arthur Andersen and Company Shipbuilding Cost

Study," which essentially agrees with the consultants' findings but challenges both their treatment of some depreciation and return-on-invested-capital accounts and the true comparability of some of the work packages used by the consultants in comparing work in Navy and private yards.

1961

146. "Reducing Costs of American Ships," by L. C. Hoffman and C. C. Tangerini, SNAME *Transactions*, 69 (1961) (WEBB).

Hoffman and Tangerini review the design and specification practices of all parties involved in procuring a new ship, see a great need for reduction of the individualistic approach of almost everyone concerned, and detail how some work could be eliminated by consolidation, while other work could be reduced by standardization.

147. "Shipbuilding Costs as Seen by the Shipbuilders," by P. E. Atkinson, SNAME New York Metropolitan Section, 23 March 1961 (WEBB).

Suggestions for decreasing cost include the following imperatives: overcome group apathy, reduce paperwork (e.g., unnecessary plans), eliminate unnecessary inspection, generalize and eliminate many unnecessary specifications, relax some American standards of construction, eliminate changes during construction, standardize components, encourage competition, and anticipate construction needs.

148. "Some Modern Procedures for Shipyard Operation," by W. H. Eckhardt and H. A. Jackson, SNAME New England Section, 24 June 1961 (WEBB).

A modern management-planning document presents the case for "common language" (identification of pieces) and "logical packages" of work.

1959

149. *Role of the U.S. Merchant Marine in National Security, The*, Publication no. 748 (Washington: National Research Council, National Academy of Sciences, 1959), 60 pp. (IDA).

This committee report documents results of the Summer Study of the Maritime Research Advisory Committee. The committee's objective was "to examine present and future military demands on the U.S. Merchant Marine in order that technical requirements can be derived for maritime research and development planning." Operating under the code name "Project Walrus," the committee had the task of advising the Maritime Administration on the "nature, organization and prosecution of a scientific research and development program appropriate to the Maritime Administration's objectives and responsibilities." The committee's report offers a number of conclusions and recommendations for achieving a more viable merchant fleet--in essence, that research and development should be aimed at creating a U.S. merchant fleet that can be self-supporting without subsidy. The report traces the historical background of the U.S. Merchant Marine, characterizes the conditions as of 1959, describes the economic and military threats, describes labor-management aspects of an improved U.S. Merchant Marine, addresses the national problem of growing foreign competition, and discusses the impact of both mechanization and automation. Finally, it outlines a broad program for achieving more mechanized and automated crew and cargo handling. The report includes a number of separate monographs that summarize sub-study analysis. Typical titles of these short summaries are--

- The Unitized Shipping Operation.
- A Maritime Research and Development Program.
- Foreign Shipping Resources (i.e., the NATO Pool of Merchant Shipping, Flags of Convenience Shipping, etc.).
- Special Cargo Ships for Military Purposes.
- The Role of the U.S. Merchant Marine in General War.
- The Military Threat to U.S. Merchant Shipping--Counter-measures.

UNDATED (LOOSE-LEAF)

150. *Shipyard MIS: A Manual for Users, The*, published by the Computer Applications Support and Development Office (CASDO) of the Naval Ship Systems Command (NAVSHIPS 0900-068-6230).

This centralized management-information system within NAVSHIPS is the responsibility of CASDO. The four general departmental areas of a shipyard--planning, production, comptroller, and supply--are grouped into three general areas of application (i.e., Industrial, Financial, and Material). NAVSHIPS' MIS system--how it works, the reports generated, the contents of the reports, etc.--is described in a series of separate pamphlets that focus on such specific areas of the system as Financial Applications (e.g., cost, budget, and payroll--covered in Volumes 01, 02, and 03, respectively). Two volumes, however, treat the system in general terms: Volume 00 supplies a general introduction to the system, and Volume 99 (aimed at upper management) describes the scope, evolution, and design concepts that led to the current system organization and discusses key reports in the system. Both volumes list and briefly describe the various volumes that document the complete system.

The NAVSHIPS MIS system is computer based, currently generates over 400 different reports, and processes data on virtually every element of shipyard operations. The Industrial Management Subsystem, for example, has five areas of application: workload forecasting, production control, production scheduling, performance measurement, and design. A separate volume (i.e., vols. 10-14) covers each of these applications.

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